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CONTENTS.

Editorial 1
Work of New York Electric Commission..... 6
Meeting of Empire State Gas and Electric Association..... 6
Niagara Falls Meeting of the American Institute of Electrical Engineers 7
The Training of Electrical Engineers..... 11
Data on Boiler Efficiencies..... 12
The Central Station Business Problem..... 12
Current News and Notes..... 13
The Generating Station for the Taylor's Falls-Minneapolis Transmission System..... 15
Track Circuit Signaling on Electrified Roads..... 20
Deflocculated Graphite 20
Concrete Bases for Poles 20
Electric Refrigeration in a Wholesale Produce House..... 21
An Electric Plant in the Andes. By M. R. Suliot..... 22
Electrically-Driven Sewage Pumping Plant at Salem, Mass..... 23
Central-Station Electric Heating Notes from Grinnell, Ia..... 24
Establishing Day Circuits in Towns of 10,000 Population and Under... 26
Electric Heating Applications..... 28
Persons Entitled to Patents. By John Edson Brady..... 29
Pull Boxes in Conduit Work By T. W. Poppe..... 31
Break-Down Service. By Charles F. Hunter..... 32
Lamp Trimmer's Wagon..... 32
Electric Work in Mills. By Arthur J. Weeks..... 32
The Regulation of Boiler Feeders—V. By Charles S. Towne..... 33
Letters on Practical Subjects..... 35
Questions and Answers 40
Central Station Sale of Current..... 41
LETTERS TO THE EDITORS:
Motors for Household Uses. By R. R. Miller..... 48
The Synchronoscope. By S. R. Dodds..... 49
Digest of Current Electrical Literature..... 49
Constant Potential Luminous Arcs..... 54
Liquid Conveying by Ejectors..... 54
Power Plants at the Charleston Navy Yard..... 55
Electrification of the Largest White Lead Factory in America..... 56
Ventilation of the Boston Subway..... 57
Industrial and Commercial News..... 58
General News 64
Directory of Electrical Societies..... 70
Weekly Record of Electrical Patents..... 71

A. I. E. E. STANDARDIZATION RULES.

The revised standardization rules, adopted at the Niagara Falls convention of the American Institute of Electrical Engineers, mark a distinct advance since the last report of the standardization committee was published in 1902. In the matter of increase of material, there has been a great advance. The earlier edition of five years ago contained about 100 numbered sections. The new edition contains about 360 numbered sections. The growth of electrical engineering has been so rapid that the original plan of the rules has had to be overturned and reconstructed. The first edition was reported to the Institute in 1899. Subjects which at that time were dealt with sufficiently in an appendix have since come to receive a full textual treatment. Thus, incandescent lamps have been dealt with in the new rules to the extent of 17 sections.

The candle-power unit is defined in the new rules as 100/88 of the hefner unit, and is recommended to be obtained from the National Bureau of Standards at Washington. The hefner amyl-acetate flame is, therefore, the acknowledged fundamental or primary standard of luminous intensity in the United States, but it is recommended that properly standardized incandescent lamps should be used as secondary standards, leaving the use of the primary standard entirely to the standard laboratories. By this means, international agreement is provided for on the basis of the hefner, while national unity of standards is also provided for, on the basis of a single source of reduction from the primary flame to the secondary standard incandescent lamp. The efficiency of an incandescent lamp is properly defined as the ratio of the mean spherical candle-power of the lamp to the watts consumed at terminals. Thus, an ordinary 16-cp lamp, consuming, say, 50 watts, would perhaps have a mean spherical candle-power of 12, and its efficiency would thus be 12/50; or 0.24 mean spherical candle-power per watt. The reason for adherence to the term "candle-power" throughout this division of the rules, instead of "candles," is probably that the term "candle" suggests the old parliamentary candle, which used to be the legal standard of Great Britain, and which was defined as a spermaceti candle six to the pound with a diameter of 7/8 in. and burning at the rate of 120 grains per hour. Fortunately, we have gotten rid of that incubus of incongruity. The hefner flame standard is indeed far from the goal of desire, and we earnestly hope for a better standard to succeed it; but even conservative England has been unable to keep her standard candle alight amid the gloom of its specifications. She has since adopted the Vernon-Harcourt pentane flame standard and now considers her candle as a decimal fraction of this. The mean spherical candle-power of a lamp is properly defined as the only correct candle-power basis of comparison between different lamps. It is hardly reasonable to expect the commercial rating of incandescent lamps to be changed to a mean spherical basis,

but in all comparative tests between lamps of any kind, the only correct criterion of comparison must be the total light emitted by each lamp, or what comes to the same thing, the mean spherical candle-power of each. It is true that for particular illuminating effects, the luminous intensity in a particular direction may render one lamp preferable to another. For example, suspended over a reading table, a lamp with a large end-on candle-power may be preferred to a lamp of the same total light emission, or mean spherical candle-power, but with less end-on and more horizontal candle-power. Nevertheless, it may be considered as a general rule that by means of suitable reflectors or refractors and desired zonal distribution of light can be obtained with but little loss, if a given total flux of light is emitted by the lamp.

The standard temperature elevations of machinery under continuous rated load have not materially changed since the last edition of the rules. The standard temperature elevation of windings remains at 50 deg. C. for the general run of machinery. On the other hand, however, a number of new clauses have been introduced relating to details of temperature tests. For example, a correction for low barometric pressures, such as are found at high altitudes, is introduced for the first time. A number of new definitions have been incorporated, which ought to be useful to the electrical business generally, such as "load-factor," "saturation-factor" and "reactive-factor." In the direction of high voltages and high-voltage testing, much new matter has been added. The highest transmission voltage classified is 88 kilovolts. The testing voltage of high-tension machinery has been placed at double the rated voltage, a marked increase in severity, but a very welcome increase in security. Altogether, the Institute is to be congratulated on the completion of this edition, which has evidently taken a large amount of work in committee. The present edition may be expected to serve usefully for several years without revision.

The Burton Bill and Niagara Falls.

The Burton bill has now become law, and the effect of its provisions has already been made apparent. The Niagara Falls present a magnificently grand spectacle, although the effect is greatly marred by unæsthetic structures and unsightly advertisements in the foreground. It also represents a total estimated available amount of power, at times of minimum flow, of some 2,300,000 horse-power, which if developed, would be worth, say, $20 per horse-power per annum, in saving over the same amount produced by coal. On these rough figures, the falls are worth $46,000,000 annually in realizable power, or capitalized at 5 per cent, not far from a billion dollars, after all of the water shall have been deflected into wheel-pits, a work of decades or of generations. A few per cent of this power are already utilized. The vast remainder, it is intended by the framers of the bill to withhold from what is called spoliation. It is, of course, entirely within the rights and powers of the peoples on the North American continent to keep Niagara Falls substantially intact for another thousand years, their estimated remaining natural lifetime. If, however, the peoples so decide, they should clearly understand the cost of their decision. They virtually throw away nearly a million dollars a week on the ornament. It is a question whether so white an elephant, and so extravagant an ornament, are worth keeping. This is a question to occupy many generations of men, whichever way they decide it, and we need not fear but that it will in the long run be intelligently answered. Meanwhile, the Burton bill, by preventing the United States from receiving more than a certain limited amount of power from Canada, artificially stimulates industrial enterprise and material development on the Canadian side of the river by forcing the Canadian market, while artificially retarding enterprise and development on the American side. From a large and humanitarian standpoint, this is a small matter, because the English speaking races receive the benefit and stimulus, either north of the river or south of it, whether they call themselves Canadians or Americans; but from a purely national standpoint a bigger gift to Canada at the expense of the United States could hardly be devised.

Progress of the New Incandescent Lamps.

We are glad to know that there seems to be a prospect that the tungsten lamp will soon be in commercial use on this side of the water. The announcement of a series street incandescent of this type is a most hopeful sign. The ordinary carbon lamp for this service has never been greatly loved by the central station man. It has not been highly efficient and its candle-power is fugitive and uncertain. If the tungsten lamp stands up well under street conditions it will prove a most valuable addition to the available material of street lighting. The filament of a series incandescent is necessarily rather stout and the tenuity of section which has been urged as an objection to the tungsten and other metallic filament lamps for ordinary incandescent circuits is obviated in applying the metallic filament to series work. It is not necessary in such work to push the filament to the highest efficiency, since it has to compete only with rather inefficient illuminants. So far as general use on incandescent circuits is concerned, the tungsten lamps have as yet made very little impression in this country, and thus far they are scarcely obtainable commercially, unless one imports foreign lamps at a somewhat excessive price. Meanwhile the tantalum lamp has come into considerable use where it has been commercially attainable. It has not to any material extent cut into the production of carbon filament lamps, but it has taken a very useful place. The tantalum lamps available in this country are claimed to have a life, on direct current, of seven to eight hundred hours, but the American manufacturer has not yet, so to speak, got the knack of the technique of manufacture so as to produce quite the degree of uniformity reached in some of the foreign tantalum lamps. There is considerable doubt as to whether the tantalum commercially obtainable for lamp filaments is of a proper degree of purity. It acts in many respects as though it were not pure, which renders uniformity more difficult of attainment. It is satisfactory to note that small tantalum battery lamps are now on the market. For this use tantalum is particularly convenient, giving a very good little lamp capable of being run easily on one or two cells of battery.

Of the new filaments, the graphitized carbon filament is the only one that has forced its way into much use. It is certainly replacing ordinary carbon at a rate that keeps the manufacturer on the jump. It is possible that the graphitized filaments are customarily rated at a specific consumption rather less than will ultimately prove desirable in attaining the most useful length of life, but they are certainly a very material improvement that is being fully appreciated. Meanwhile it is about time that we heard something more from the Helion lamp. Aside

from its interesting chemical features this illuminant is the only one of the new incandescents which possesses a filament comparable in size with the ordinary carbon filament and possessing a considerable degree of mechanical strength; it therefore gives promise of lamps for use on ordinary incandescent service in small candle-powers. A 20-watt, 16-cp lamp will appeal powerfully to users, and unless some movement is soon set on foot to increase the normal unit to 25 cp or larger. the central stations may look for trouble in the future.

GROUNDING ALTERNATING-CURRENT SECONDARY CIRCUITS.

The question of grounding secondary alternating-current circuits was again brought up at the recent National Electric Light convention in Washington, and the report of the committee which was adopted this year recommended that the grounding of such secondary circuits be made compulsory by the underwriters for all circuits where the potential between any conductor and ground does not exceed 150 volts. Several eminent authorities were quoted as expressing decided views to the effect that such grounding should be absolutely required in the interests of safety to human life. In view of the constantly growing sentiment in favor of such grounding and the unquestionable safeguards which it affords, it is to be hoped that the underwriters will follow this recommendation and soon make such grounding compulsory. It should have been made compulsory long ago, but there is always a certain amount of inertia to be overcome prior to mandatory action, and after all it is not so very many years since such grounding was not authorized at all by the underwriters. As to methods of best securing ground connections, the committee was not prepared to make definite recommendations except that wherever possible ground connection be made to water pipes. It did recommend, however, that more information be gathered as to suitable methods of grounding. The N. E. L. A. convention proceedings of 1906 contained considerable information of value on grounding under different conditions. We have previously noticed a number of methods for this purpose, but it will do no harm to recapitulate them here, since the subject is a very live one and should receive much more earnest attention than it does.

One of the surest methods is undoubtedly that of grounding to water pipes at each customer's service as recommended by the committee. This, however, involves considerable expense in some cases, and until grounding is required by the underwriters there may be a few cases where the waterworks officials may object. Another method which has been found cheaper than grounding at each service in some localities is that of running a continuous ground wire from a station or sub-station over the entire distribution system, this wire being well earthed at points where good grounds can be secured. The method which has heretofore been suggested in the National Electrical Code, namely, that of burying a copper plate in the ground at each transformer, this plate to be surrounded by coke, works well in damp soils, but in New York and Boston and probably in many other cities, has been found to be a very uncertain method because of the uncertainty of permanent moisture. In soils where there is always moist clay to be found a short distance below the surface, as in many portions of the Middle West, the ground plate plan works fairly well, but even there it is a question whether equal reliability is not secured by a cheaper method, namely, that of driving 10 ft. of galvanized iron pipe into the ground and making a solid soldered connection with the top of the pipe.

THE ILLUMINATING ENGINEERING OF SMALL RESIDENCES.

The planning of the electric illumination in the majority of small residences must for many years to come rest largely with the central station company; that is, if the illumination is to be planned at all instead of being laid out in a haphazard way, as it is in the majority of cases at present. The specialist in illumination is not even now by any means called in as often as he should be in connection with large and important buildings, but as time goes on this condition of affairs will gradually change either by an increase in knowledge of illuminating subjects by architects, or by the employment of special illuminating engineers to supplement the work of the architects. In the case of the majority of small residences in any city, it is hopeless to expect that the owners or builders will go to the expense of employing special expert advice on the lighting. Yet it is in these small dwellings that economical and efficient arrangements are most important, both to the consumers and to the central station company. If the electric lighting arrangements are not efficient, the company will lose this valuable class of business, which in the aggregate is one of the best classes of lighting load a central-station company can have, because of its size, stability and comparatively good load factor. Summed up briefly, the owner or builder will not appreciate the importance of good design of the lighting and will not pay for expert advice. It is therefore up to the central station, as the most interested party, to step in with such advice. If the central station company does all the wiring in a town (as is the case in some of the smaller towns) it has an excellent chance to see that the customer has an economical arrangement. Where the company does not do the wiring, it is not so easy to influence the design of the installation, but it can be done.

If the central station company is wide-awake, it has solicited every prospective residence customer before the wiring is done. The company will therefore know about the time that a house is being wired and can give the customer advice. One of the hardest propositions to handle is that of the builder who is putting up large numbers of dwelling-houses for sale or rent. The builder of such houses usually wants to make the biggest show he can for the money, and as he has no interest in the illuminating results after the house has passed out of his hands, he sometimes figures that it is a waste of money to put money into lighting circuits and fixtures, the cost of which does not appeal to the casual inspector of a new building. In other words, he asks why he should spend a few dollars extra in each house on items which do not make much of a showing and will probably add nothing to the price he can demand. The only way to overcome unprogressive arguments of this kind is to persuade the builder that it is worth while to make his buildings thoroughly up to date and to impress his customers with that fact, adding to the selling price accordingly. However, it is not always true that lighting arrangements which will be economical in operation are more expensive than those which are not. The addition of a few cents here and there frequently converts a very poor arrangement into a

very good one. The main thing is to persuade the builder to put in outlets and fixtures according to the company's recommendations. It goes without saying that where a company sells fixtures and has certain standard fixtures with which it does low-priced residence jobs, these fixtures should be of a kind which will make good results possible. We have seen too many cases where companies which ought to have known better have clung year after year to some inefficient styles of fixtures for putting in inexpensive houses; this, too, in spite of the fact that the company had men in its employ who knew better and that the right kind of fixtures would have cost no more. If the company (which has in its employ more talent in illumination than all the rest of the community) is careless and indifferent to these things, is it in the least to be wondered at that the rest of the community is indifferent except when it comes to paying the bills? And even in the latter event it is the company who has to take the kicking and suffer the loss of patronage.

Non-Peak Loads.

The National Electric Light Convention paper of Mr. George N. Tidd, printed elsewhere in this issue, is of value as expressing the views of one of the leaders in the movement of central-station managers to secure motor business under contracts which provide for the shutting down of the manufacturing plant during the hours of the central-station peak load in order that the manufacturing plant may get the benefit of a very low rate. Mr. Tidd was one of those who, at Marion, Ind., went ahead and did what many managers had solemnly asserted in convention could not be done, namely, the securing of large non-peak power contracts of this nature. Mr. Tidd had many obstacles to overcome, including the objections of union labor to changing the standard hours of work; but these difficulties were all surmounted and the results are high-load factors which might well give central-station men food for thought.

Under-Developed Central Stations.

Some of the information presented at the last N. E. L. A. convention, together with much which has been published in our columns the past year, as to the earnings of some central-station properties per capita of population and per kilowatt of station capacity, should be powerful incentives to central-station companies which have not been making the most of their opportunities in times past. If the directors of the many much under-developed central station properties of this country ever get to the point where they take enough interest in the business to study some of the information referred to, it will result in a general stirring-up. Great interest was displayed at the recent convention in the earnings of a small Ohio central station which, without a contract for municipal street lighting, is said to be earning $8.50 per capita of population. Considerable has been said in the past few years about the troubles of the small central station and the way it is suffering from lack of proper management. This is perfectly true of the majority of such stations, but there is an enterprising minority which has been able to give pointers to the larger companies. Indeed, on the whole, we are inclined to think that the most under-developed central-station properties in the country to-day are those in the larger cities. There are certainly splendid opportunities for development all along the line in both large and small cities for both large and small combinations of capital.

The Income Value of Various Heating Appliances.

It is generally accepted that of all the electric heating appliances available, the electric flat-iron is the one which will yield the best revenue to the central-station company for a given amount of money spent in introduction. This is because it is used with tolerable regularity. It is a time and work-saver, a special blessing in summer, and altogether an appliance which is bound to remain popular with users, while at the same time it consumes enough current to make a decided increase in the gross revenue from residence customers. The flat-iron campaign has been fairly well started by most progressive central-station companies, and about this time doubtless many companies will be asking what is the next heating appliance which it will pay best to push, revenue, usefulness and ease of introduction all being considered. If the vote were taken on this question, we surmise that it would be divided between the electric chafing dish and coffee percolator, very likely with the majority in favor of the coffee percolator, which has the advantage of making a beverage which is very generally used and hence is likely to be in regular service every day on the dining-room table. It must be confessed, however, that the difficulty of cleaning some of the percolators which have been put out in the past has prevented their regular use even by those who have purchased them. They are unquestionably more trouble to keep clean than the regular coffee pot.

We are inclined to think that with the proper campaign of education in any given community, the electric chafing dish can be made to go farther toward filling a popular demand and yielding a steady income than any other electric heating device except the flat-iron. The chafing dish has a great variety of uses, not only for fancy dishes and late suppers, but for common, every-day cooking. The variety of things which can be done on a dining-room table with an electric chafing dish is surprising to those who have paid no attention to the matter. It must be recognized at the outset, however, that there exists a popular idea that a chafing dish is something to stand on a sideboard and look handsome and to be used on state occasions only. Any central-station company starting on a chafing-dish campaign will have to meet this view and show what a common, every-day necessity an electric chafing dish can become. In this connection it may be noted that one of the best known works on chafing-dish cookery starts out by calling attention to the usefulness of the chafing dish for every-day cooking, but immediately and for the rest of the book devotes itself to elaborate and fancy dishes. Some of the central-station companies which have been spending money advertising electric cooking in general might do well to concentrate their efforts on demonstrations and education of their communities on this one subject of chafing-dish cookery. Once the chafing dish is introduced for common use on a dining-room table, other electrical appliances useful in light housekeeping will follow.

It does not follow from the above considerations that the companies which have made a good start in the introduction of complete electric-cooking outfits should discontinue their efforts. Where gas competition is not present or where light housekeeping is to be done, even if gas service is available, complete electric-cooking outfits stand a first-class chance if

the rates are right. But when it comes to advocating appliances like the chafing dish and other things which can be used on the dining-room table, gas competition is not to be considered, as they can be introduced whether there is gas in the house or not. There is no real competition of these devices, because cooking by gas or alcohol on a dining-room table is justly never to become popular.

SPECIAL VERSUS STANDARD SIGNS.

Considerable difference of opinion exists among central stations which have been pushing the sign business as to the relative merits of special designs of electric signs for customers as against regular standard forms. The advantage of the specially designed sign is pointed out to be that every large merchant likes something a little different from the other merchants in the city, and if only a few set forms are used, part of the incentive to purchase and operate an electric sign is destroyed. On the other hand, it is claimed that the regular standard forms are more durable, produce a more uniform appearance on a street if used extensively, and give a customer more for his money than can be given in a special design. We will not presume to pass judgment on this question, which is partially one of the size of the customer to be dealt with. Very large customers naturally require special signs because there are no standard forms regularly made in very large sizes. On the other hand, the small customer cannot afford to go to the expense of having a special sign made, or if the special sign is made for the price of a regular standard sign, it must be of such inferior quality that it is hardly to be considered. In the majority of electric signs, both special and standard, there is room for improvement in legibility at a distance. The heavy block letter has been used too much in the past for the good of the electric sign business. It permits too much of a blurring between the lines of a letter. More open lettering to prevent blurring will be popular in the future.

MEETING THE PUBLIC HALF-WAY.

Almost an entire evening session at the recent National Electric Light Association convention was given to a discussion of the report of the Public Policy Committee, the acceptance or rejection of this report involving the question of what should be the attitude of the association toward regulation and control of public service corporations by state commissions or similar bodies. The report of this Public Policy Committee, which is printed in abstract elsewhere, promulgates some doctrines which would have been thought most dangerous and disloyal to the interests of corporations by corporation officers a few years ago, and it simply goes to show what an evolution has been going on the past few years in the attitude of both the public and the corporations. In the first place, it is being popularly demanded that the power of corporate wealth be kept in its legitimate channels, or, as an alternative, that corporate ownership be abolished and public, or municipal, ownership substituted in its place. We have within the past two years a number of times reflected the opinion of leading central station men that proper supervision of the business by a state commission or something of the kind is desirable, not only on account of the public, but because investments should be more secure where supervision goes so far as to prevent stock watering and unnecessary and injurious competition. The report also gives deserved condemnation to the old-fashioned limited term "franchise laws," which are so common.

In the majority of states, it must be confessed that the laws are at present very unsatisfactory as regards franchises, both from the standpoint of the corporations and the public. The usual rule is to grant a corporation a franchise for a limited term of years, usually not exceeding 25 years, which practice is likely to keep a company in a most uncomfortable state of uncertainty for at least half of the period of its franchise. Suppose, for example, a company has a franchise for 20 years. For the first 10 years of its life little thought is usually given to what is to occur at the expiration of the franchise, and money is put in freely to develop the property as it should be developed for the best good of the company and the community it serves. When the franchise period enters the second 10 years, investors will begin to ask what is to become of the investment at the expiration of the franchise. At first sight it appears that investors would shrink from putting money into an enterprise that in a few years will have no legal right to carry on its operations, but, in fact, they are usually inclined to take the chance that an extension of franchise on living terms will be granted, and needed money is forthcoming. Nevertheless, there is unavoidably a period of more or less duration near the end of the company's franchise in which this uncertainty is likely to prevent proper development. It may be contended that if the company goes ahead in good faith and keeps its property in excellent condition, there should be no difficulty in securing the right kind of a franchise at the end of its term. There is much in this argument, but, nevertheless, what with the agitation for the regulation of corporations, and municipal ownership politicians ambitious to make political capital out of squeezing corporations as hard as they can, the companies whose franchises are soon to expire are in an unenviable position.

The result of all this uncertainty during the last five years of a company's franchise is likely to be inferior service to the community owing to the fact that capital cannot be obtained for needed enlargements and improvements. This in itself is likely to stir up a feeling of unrest and dissatisfaction with the company and so matters act and react, from bad to worse. There is, in fact, no fundamental reason why a company having an immense investment in permanent property in public streets should be placed in such a position at regular intervals that it can be driven off the streets or can be made as an alternative to accept a franchise in which there is no justice. The public service company should be allowed to do business continually in a city as long as it behaves itself properly and gives good service; nor should it be allowed to give poor service or charge extortionate rates for 10 or 20 years simply because it has a franchise. Occupancy of the streets, when it is to be dependent on proper treatment of the public, involves, of course, some method of continuous regulation by commission or otherwise. This has some objections, but it seems to be the lesser of several evils. A little house-cleaning once a year or oftener is better than a frightful upheaval once in 20 years.

Work of New York Electric Commission.

The New York State Gas & Electric Commission went out of existence on June 30, and cleaned up a lot of its work before doing so, relieving the new Public Utilities Commission to that extent. The commission ordered the reduction of the price of electricity supplied by the Saratoga Gas, Electric Light & Power Company from 12½ cents per kilowatt-hour to 8 cents per kilowatt-hour, to take effect Sept. 1; the price of electricity in Mount Vernon, supplied by the Westchester Lighting Company, reduced from 20 cents a kilowatt-hour to 13 cents, to take effect Sept. 1; the price of electricity in Orangeburg, supplied by the Rockland Light & Power Company, reduced from 20 cents to a maximum rate of 15 cents a kilowatt-hour outside of incorporated villages, to take effect Sept. 1.

The commission authorized the issue by the Utica Gas & Electric Company of 5 per cent refunding 50-year gold bonds to the amount of $2,000,000 for meeting betterments heretofore incurred and in process of construction on the plant of the Utica company and its subsidiary companies.

The application of the Oriskany Hydro-Electric Company proposing to operate in the counties of Oneida, Madison and Chenango, for a certificate of authority to transact business and for consent to issue first mortgage 5 per cent 40-year gold bonds was denied. The company asked for consent to the issuance of bonds to the amount of $400,000.

The application of the village of Potsdam for a certificate of authority to establish and operate an electric lighting system for commercial purposes was denied.

A certificate of authority was granted to the Sayre Electric Company, a foreign corporation, operating in Sayre, Pa., to transact business in Waverly, Tioga County, N. Y., and also to lease the distributing system of the Waverly Electric Light & Power Company for a term of 99 years.

The application of the Champlain Electric Company for consent to increase its capital stock from $15,000 to $30,000 was denied.

Consent was given the Canton Electric Light & Power Company to increase its capital stock from $18,000 to $38,000.

The application of the Suffolk County Lighting Company for a certificate of authority to transact business in the town and village of Babylon, Long Island, was granted.

Meeting of Empire State Gas & Electric Association.

Following the annual meeting of the New York State Street Railway Association at Hotel Champlain, Lake Champlain, last week, a meeting was held at the same place on June 27 by the Empire State Gas & Electric Association, to consider the relationship of the traction and lighting interests to the new Public Utilities law. There was a good attendance, and, in the absence of President Palmer, the meeting was called to order by Mr. T. R. Beal, who stated briefly the objects of the meeting.

The first business was the reading by Mr. H. H. Curran of a paper or report on the publicity work of the association, showing how much had been done to secure the publication of facts and data in the newspapers, informing to the public and helpful to public service corporations. Details were given as to the wide use of a number of special articles on facts connected with the industry. On the political side also, good work had been done in combating misrepresentation as to the results of municipal ownership, alleged fires caused by electricity, etc. An average circulation of about 300,000 had been enjoyed by the articles issued by the bureau for the association. This work is estimated to cost about $10,000 a year, including the maintenance of the association's secretary's office and staff. Mr. Arthur Williams pointed out various ways in which the work might be extended.

Mr. J. N. Shannahan, ex-president of the State Street Railway Association, addressed himself, by request, to a brief discussion of the scope and bearing of the public utilities law, in regard to which he felt that the companies in allied fields must work together, possibly through some joint organization that could handle the subject efficiently and present a common front for them to the people who legislate or who seek legislation at Albany. Where there was no concerted action, bad measures slipped through.

Mr. Beal suggested that as the law treated them all in the same manner, it might be well to combine all interests in one federal association. Indeed, many of the companies were interested in three or four fields of public service.

Mr. Arthur Williams pointed out that among the national associations that was virtually accomplished not by amalgamating, but through "public policy" committees that worked together. That seemed to him a better way. Each industry had its own problems. At the recent meeting of the National Electric Light Association 70 papers were read on as many topics.

Mr. W. W. Freeman returned to the main topic of the new law, which many of them, he said, regarded as unduly harsh and drastic. He thought that the association ought to have a clearing house whereby a report could be had on the general operation of the law, enabling the body to suggest proper and necessary modifications. It would be helpful to keep a complete record of every transaction of the members with the commission as a basis for future effort.

A brief discussion then ensued as to the Massachusetts law and as to one or two features of the New York law.

Mr. J. M. Wakeman then suggested the desirability of a public utilities state committee, an idea which was generally approved. He then made a motion to the effect that the meeting refer to the executive committee of the association, for consideration and action, the appointment of such a committee composed of representatives from the association to collect information relative to the action of the public utilities commission in regard to applications made to it during the year; and that the committee suggest to the executive committee of the Street Railway Association of New York State that they also appoint such a committee; that these two committees shall meet jointly and make a report which shall be read by the secretary of each association at its annual meeting; that the committee consist of three members from each of the associations, the secretary of each being a member ex-officio; that the secretaries obtain the information presented to the committee and make reports to the respective associations. This was unanimously adopted. There was a little further discussion, but no other action on the subject.

The next matter treated was that of uniform accounting. Prof. B. V. Swenson, secretary of the American Street and Interurban Railway Association, referred to the general adoption of a standard system by street railways, recognized also by state boards and by the United States Census Office.

The subject of gas accounting in its relation to the requirements of the law was also discussed, but nothing was done, and after lunch the broad topic was taken up again in a paper by Mr. C. H. Hart, who submitted a scheme and general outline for gas and electric companies. There was a brief discussion on this dealing with technical points of reserve, operation, depreciation, etc. It was finally agreed, on motion of Mr. Arthur Williams, to recommend to the executive committee the appointment of a committee of three accountants to work in conjunction with corresponding committees of the American Gas Light Association and the American Street Railway Association for the purpose of formulating a method of accounting to meet as nearly as possible the conditions found in the various lighting companies of the state; that using as a basis the work up to the present time of the national societies, the accounting committee of the association prepare a report and a recommendation for submission to the Public Utilities Commission after approval by the executive committee.

Mr. R. A. Davidson then read a brief paper on "Fire and

Liability Insurance for Gas and Electric Companies," suggesting methods by which the companies could secure lower rates than are now accorded them. On motion of Mr. W. W. Freeman, it was recommended to the executive committee to print and distribute the paper to all lighting companies in the state. There was a brief discussion on mutual insurance, and such practice in Cleveland as to street railways and in New York as to lighting plants was cited by different members. Mr. Freeman stated that this insurance method in New York was applied also to accident liability. A recommendation was made for a committee on the subject. The meeting then adjourned.

Niagara Falls Meeting of the American Institute of Electrical Engineers.

The meeting of the American Institute of Electrical Engineers at Niagara Falls last week was a pronounced success, it being some years since so large an attendance was secured. At first it looked as though the representation would be slim, but members arrived steadily each day up to the very close of the convention and nearly 470 were registered. Allowing about 100 for local attendance and committee, this gave not less than 370 from different parts of the country and Canada, and Dr. Sheldon was very much gratified, with the other officers who had worked hard to ensure the success of the occasion.

In addition to the regular entertainments noted on the printed programme, there was an interesting special episode of the kind, due to the courtesy of the local committee, who on Friday evening took a party of over 80 by trolley car down the Gorge to the Whirlpool Rapids. There, for about an hour, a searchlight was played upon the raging mass of foam, and the vari-colored effects excited much interest. The party enjoyed the spectacle immensely and were loath to leave it.

The appeal made to the members present to contribute to the building fund, if they had not already done so, was attended with happy results. A number of members who had not previously given any thought to the matter hastened to subscribe, and the end of the week saw the fund richer by not less than $1,100, giving it a decided impetus toward the goal of $185,000. The amount now raised is about $166,000.

During the week there was not a little talk and discussion as to the next annual meeting of the Institute. It will be the twenty-fifth, and will therefore be a landmark in the history of the body. There is a general desire to make the occasion memorable in various ways.

Following are abstracts of the discussions of papers read on Wednesday, Thursday and Friday:

TRANSFORMERS.

Three papers on transformers led to an interesting discussion. One of the papers was by Mr. S. M. Kinter on "Choke Coils versus Extra Insulation of the End Windings of Transformers;" another, by Mr. Walter S. Moody, on the "Protection of the Internal Insulation of a Static Transformer against High Frequency Strains," and the third, by Mr. H. W. Tobey, on "Notes on Transformer Testing." The discussion on these papers was opened by Mr. A. H. Pikler, who expressed the opinion that neither the extra insulation of the end turns of a transformer nor the use of choke coils can be considered as a perfect preventive of troubles from lightning, when used alone. It is far preferable to provide a moderate amount of extra insulation for the end turns and to use a small amount of external inductance. Mr. K. C. Randall stated that it is extremely desirable in any event to use a certain amount of external inductance.

Mr. D. B. Rushmore discussed in detail the disastrous effect of an arcing ground in producing high potential strains in a transformer. Under some conditions a choke coil is undoubtedly desirable, but there are cases where it in itself may cause excessive voltage rises. Mr. P. M. Lincoln agreed with the conclusions of Mr. Kintner as to the value of an external choke coil, because, although there is an active voltage between each turn of a transformer, and a short circuit between such turns may produce an enormous current, an exactly equal short circuit in a choke coil due to any excessive voltage across such coil can produce no result worse than eliminating the coil from the circuit.

Mr. E. J. Berg explained the great advantage arising from cutting out unnecessary turns from the middle of the transformer rather than from the end when one wishes to vary the voltage upon a transformer whose end turns are given an extra amount of insulation.

Mr. W. M. Smith called attention to the increased expense of repairing any defects in a transformer which depends upon the extra insulation of the end turns for protection in comparison with the expense connected with replacing a damaged choke coil. The time has arrived when choke coils should be standardized. Each coil should be placed where no flash can reach it, and where it can cause no damage in itself. Mr. C. W. Stone stated that choke coils have not been found advantageous for use with cables on account of their inability to protect a cable from internal disturbances. Prof. E. E. F. Creighton explained, on the basis of resonance, the phenomenon sometimes observed of a higher voltage being produced at the transformer terminals inside of the choke coil and at the outside of the choke coils nearer the transmission line. He stated that cases have been known where inner turns of a transformer have been damaged without injuring the insulation of the end turns, even when the inner turns were equally as well protected as the outer turns. Mr. William McClellan expressed the opinion that it will be necessary to continue the use of choke coils in connection with transformers until there has been produced an arrester having the essential characteristics of a safety valve. Such a transformer is promised in the new electrolytic type.

Prof. Morgan Brooks reported the results of a series of observations which showed that excessive voltages may be produced in the secondary of a transformer by closing the primary circuit at certain points of the e. m. f. wave. Mr. W. S. Lee expressed his preference for the installation of both choke coils and extra insulation of the end turns in connection with lightning arresters. Experience has shown that the weakest point of the high potential transformer is in the terminals, rather than in either the end turns or in the choke coils. Mr. Ray P. Jackson stated that the effectiveness of a choke coil depends almost exclusively upon its inductance. The experience seems to indicate that the inductance should have a value of about .04 or .05 henries. If the end turns of a transformer are insulated and used for protection, the extra insulation should cover such a length of turn as to include this amount of inductance. It is found that with large transformers the required number of turns is not unreasonable. In spite of this fact, however, it seems more desirable to use external choke coils. If the arrester in itself is perfect there would be practically no need for a choke coil. Moreover, modern transformers are so constructed that when used in connection with proper choke coils there is no need for extra insulation.

Dr. C. P. Steinmetz said that choke coils may be advantageously located within the transformer tank when oil insulation is used. They should, however, be so placed as to protect all of the apparatus within the station or sub-station. Thus, if a switch is located between the transformer and the external line a choke coil in the transformer case will not protect the switch. For most installations it is preferable to place the choke coil out of doors and depend upon air insulation. The transformer itself should also be protected by means other than the choke coil itself. At a very high frequency, such as 30,000 cycles per second, there may be an enormous rise of e. m. f. inside of a choke coil due to resonance. It is desirable in most cases to use only that amount of inductance which is absolutely essential to the operation of the lightning arrester equipment. Mr. R. D. Mershon called attention to the fact that even in case a transformer is wound for two voltages, one having half the value of the other, it is not necessary to use an extra amount of insulation for the end turns, because the turns which are given extra insulation may be designed for the

largest current which the transformer will carry and may be used to carry such current both when the coils are connected in series and in parallel. In any event, however, the best results will be obtained when a choke coil is used and such choke coil should be of the air-insulated type and placed out of doors.

Mr. W. L. R. Emmet called attention to the fact that the best protection is afforded by a device which is non-elastic. That is to say, it is preferable for the device to absorb energy and to dissipate it, rather than to store it and then give it up to the system.

Mr. O. S. Lyford, Jr., suggested that on account of the fact that the weakest point in a transformer equipment is in the terminals all of the apparatus requiring high potential terminals should be placed within a single oil-insulated case. This case should contain the choke coil and the series transformer, when such is used.

TRANSMISSION LINES.

Mr. D. R. Scholes presented a paper on "Transmission Line Towers and Economical Span," which was followed by a paper by Mr. Norman Rowe on "Lightning Rods and Grounded Cables as a Means of Protecting Transmission Lines Against Lightning." These papers were discussed by Messrs. Hoopes, Fleming, Neall, Mershon, Thomas, Lee, Paine and Ricker. Mr. Mershon stated that experience of the Niagara, Lockport & Ontario Power Company's transmission lines during a certain time showed that 76 per cent of the trouble was encountered on the type insulator. In view of past experiences the company is now employing horn arresters, which are so arranged as to act both as arresters and as lightning rods; that is to say, the side of the horn arrester which is connected to the ground is extended upward above the transmission line so as to act in the capacity of a lightning rod. Mr. W. S. Lee said that quite independent of any consideration of the most economical span that may be employed in a certain transmission line, the contour of the country to a large extent determines the length of the span which must be used. This is especially true in mountainous regions. Where there are numerous hills and valleys a single pole can be placed on top of each hill and long spans employed, or two poles can be placed on each side of certain hills and long spans employed across adjacent valleys with short spans over the hill-top.

At the session of Wednesday evening the following papers were presented: "The Transmission Plant of the Niagara, Lockport & Ontario Power Company," by Mr. Ralph D. Mershon. "Location of Broken Insulators and Other Transmission Line Troubles," by Mr. L. C. Nicholson. "A New Type of Insulator for High Tension Transmission Lines," by Mr. E. M. Hewlett. "Some New Methods in High Tension Line Construction," by Mr. Harold W. Buck. "Switchboard Practice for Voltages of 60,000 and Upward," by Mr. S. Q. Hayes.

Replying to a question in the discussion of the above papers as to excess strains that have been placed upon the spans across the Niagara Gorge, Mr. F. B. H. Paine said that the object in using such a strain was to permit of locating the towers near the water's edge and to prevent swinging of the wires across the Gorge. Mr. D. B. Rushmore stated that in many long-distance transmission systems an excessive amount of money is expended for insuring continuity of service. He expressed the opinion that such continuity may be obtained more cheaply by the use of a steam power auxiliary plant at the point of distribution. Mr. William McClellan stated that the durability and effectiveness of a transmission installation depend to a very large extent upon the insulators. The insulator described by Mr. Hewlett seems to be almost ideal in this respect. Mr. Hewlett stated that each of the disks of the link insulator is capable of withstanding a voltage of about 65,000. It is rated at 25,000 volts, so that a large factor of safety is used. For 60,000-volt transmission work either two or three disks are placed in series. In reply to a question by Mr. W. M. Smith as to the formation of ice, Mr. Hewlett stated that no trouble from ice is anticipated, because observations have shown that when ice forms in the pocket in the top of a disk it is forced outward without cracking the disk or damaging it in any way. When several insulators are placed in series the total voltage is not divided uniformly across the various insulators, but the lack of uniformity is not excessive.

DEFLOCCULATED GRAPHITE.

A paper by Mr. E. G. Acheson on "Deflocculated Graphite," is printed elsewhere in abstract. In the discussion in reply to a question, Mr. Acheson stated that while the experience with deflocculated graphite in solution as a lubricant is limited, observations show that there is no tendency for the solution to become more dense and viscous. However, there is a slight accumulation of graphite in the bearings, so that after the supply of lubricant has been cut off the friction is not increased appreciably for a considerable time. The new lubricant has been found well suited for high-speed and high-pressure operation. He asked the cooperation of operating engineers in determining its lasting qualities under severe service.

THE ELECTRIC RAILWAY.

Three papers relating to the electric railway gave rise to an interesting discussion. The titles of the papers are as follows: "Single-phase versus Three-phase Generators," and "Choice of Frequency for Single-phase Railways," by Mr. A. H. Armstrong. "Twenty-five versus Fifteen Cycles for Heavy Railways," by Mr. N. W. Storer. "Cummutating-Pole Direct-Current Railway Motors," by Mr. E. H. Anderson. The discussion was opened by Mr. Paul M. Lincoln, who said that in the electrification of steam railroads, the electrical equipment used for propulsion will not be connected in any way with other electrical equipments, so that any discussion of the limitations of a certain equipment for combined duties is irrelevant. Mr. H. G. Stott showed that a three-phase star-connected generator can supply power to single-phase and three-phase loads by using the equivalent of a four-wire system for single-phase loads, and a three-wire system for the polyphase loads. Mr. Wm. McClellan showed that some simplicity is obtained by using a T-connection, because in this event the load need be divided into only two instead of three parts, and an inequality of the two parts does not seriously affect the operation of the system.

Prof. C. P. Steinmetz explained that an induction regulator cannot be employed for supplying a balanced load on a polyphase generator when the load on the system is single phase. He showed that the effect of a single-phase load between two leads on a three-phase system tends to decrease the voltage between these two leads and between one of these leads and the third lead; the voltage between the other lead and the third lead is, however, affected very little. Any lamp load should be placed across between the latter two leads. Mr. E. J. Berg called attention to the fact that the speed limitations in low-frequency generator design have been overcome in the Stanley alternator, which is a special type of generator supplied with low-frequency alternating excitation. Mr. M. M. McClellan discussed recent developments, and stated that while for the types of motors that have already been introduced for railway work a frequency of 15 cycles is preferable to one of 25 cycles, the last word has not yet been said as to present and future developments of other types. The limited information that has been given out concerning new types would lead one to wish to wait for further developments before accepting either the one frequency or the other as the standard.

Dr. Steinmetz showed that for each type of alternating-current apparatus there is a certain range of frequency at which it operates most advantageously. Thus, for stationary transformers the economical range is very high, in fact above the frequencies ever used commercially. Generators have a limited range of frequency, the most economical frequency varying with the character of the prime mover and the output of the generator unit. Small induction motors can be built more economically for 60 cycles than for 25 cycles, while the reverse is true of large motors. The proper frequency for rotary converters is about 25 cycles. The single-phase series motor operates more and more

economically the lower the frequency. Such is not true, however, of the alternating-current railway motor invented by Mr. E. F. W. Alexanderson. This motor operates more economically at 25 cycles than at 15 cycles and the commutation is excellent. In this motor the improvement in commutation is due to the neutralization of the e. m. f. in the short circuited coil, rather than to a lowering of the frequency for a given flux of the insertion of resistance to decrease the short-circuit current.

Mr. P. Junkersfeld called attention to the fact that the power necessary to operate steam roads is ordinarily grossly overestimated. Careful estimates and observations show that all of the roads radiating from Chicago for 25 miles would use only about 25 per cent of the electrical generating equipment now installed in Chicago.

Mr. Gano S. Dunn said that present trend of development seems to indicate that the commutating-pole machine will be the predominating type of the future for many purposes. It is especially suited for high-speed generators, variable-speed motors and direct-current railway motors. There are cases, however, where the extra poles and windings involve a prohibitive amount of complication, and the ordinary design is more economical. Such a case is found in the constant-speed motor.

In reply to a question as to the extent to which high-voltage railway motors have been employed, Mr. Anderson stated that although no 1200-volt railway motors are yet in service, many orders have been received for such machines and the motors have been built and tested. Even at an e. m. f. of 1800 volts the commutation has been found to be entirely satisfactory. The danger of flashing has been eliminated by removing the prime cause therefor, namely the collection of carbon dust on the commutator and neighboring insulated parts. A commutating-pole motor is subject to so little disintegration of the brushes that there is no accumulation of carbon dust.

CODE OF ETHICS.

A proposed code of electrical engineering ethics was submitted by Dr. S. S. Wheeler, the chairman of the committee on the code, who moved its acceptance by the membership of the Institute, it having already been approved by the board of directors. In seconding Dr. Wheeler's motion, Mr. William McClellan called attention to the fact that the committee, which consisted of the chairman noted above and Messrs. Steinmetz and Buck, represented all classes of interests connected with the work of the Institute, and that this committee had conscientiously considered all phases of the relation of the electrical engineer to the various persons with whom he deals professionally. Mr. H. G. Stott expressed his disagreement with several clauses as worded, and offered an amendment to Dr. Wheeler's motion to the effect that the acceptance of the code by the membership be postponed until a letter ballot could be obtained from the full membership. After a lively discussion, participated in by Messrs. G. S. Dunn, H. W. Buck, S. S. Wheeler, R. W. Pope, C. P. Steinmetz, C. W. Ricker, C. W. Stone, Carroll Thomas, C. F. Scott, W. L. R. Emmet and N. W. Stoher, an amendment to Mr. Stott's amendment, which had been proposed by Mr. Dunn, was passed, according to which latter amendment the Institute accepted the code in its present form, but will call upon the general membership for criticisms in view of making certain changes during the next year. For the purpose of conducting this work, the former committee was reappointed for another year. Dr. Wheeler announced that the Institute code was the first code of ethics to have been adopted by any engineering society in America. At a later session it was announced that the action of the convention in adopting the code was unconstitutional, as that body could only make recommendations to the board of directors on matters affecting the policy of the Institute. By vote the code was then referred to the board.

ENGINEERING EDUCATION.

Prof. H. H. Norris presented a paper on "The Attitude of the Technical School Toward the Profession of Electrical Engineering," which was followed by a paper by Prof. V. Karapetoff on "The Concentric Method of Teaching Electrical Engineering." Prof. J. A. Shaw objected to the practical exclusion of mathematics from a student's first year in college, as proposed by Prof. Karapetoff. For acquiring information concerning engineering practice a little experience in power plants and manufacturing establishments is far preferable to any laboratory course in college. It is possible to give the student an excellent idea of the relation of the several sciences if all chemical, physical and electrical transformations be discussed on the basis of energy changes.

Prof. F. B. Crocker stated that electrical engineering should no longer be considered as a branch of mechanical engineering. In many colleges electrical engineering has sprung from either physics or mechanical engineering, to which it yet remains attached. At Columbia, however, electrical engineering has always been treated as a subject complete in itself, and related to mechanical engineering just as the latter is related to civil engineering.

Mr. Gano S. Dunn expressed great satisfaction at the attitude of the Institute towards engineering education. The training which a student receives at a technical school is of such a nature as to render it valuable to a person in practically every line of work, such as banking, merchandizing, contracting, etc., in addition to the usual engineering work. No subject is of more importance than the instruction of students in engineering schools, so that the methods employed should be considered most seriously. Doubtless the best results will be obtained from a broad general training rather than a narrow specialization.

Dr. Samuel Sheldon expressed the opinion that the proper solution of the problem of instructing students in engineering can be found only in eliminating incompetent instructors and employing proper teachers. Men who are capable of becoming good teachers are in great demand in other lines of work in which the compensation is more inviting. Undoubtedly a considerable improvement would be made if the members of the teaching profession were better paid.

Prof. G. W. Patterson made a plea for education along broad lines and stated his belief that the method proposed by Prof. Karapetoff would not turn out a desirable product. Prof. L. W. Gill stated that instead of teaching theory first and then practice, as is usually done at present, or practice first and then theory as proposed by Prof. Karapetoff, it is preferable to teach practical and theoretical subjects together. The problem of rendering the subjects interesting to students can be solved readily by adopting proper methods of presentation.

STANDARDIZATION.

The revised standardization rules of the Institute, which have been changed in form and wording in accordance with various suggestions received from members during the past year, were adopted without discussion and without any dissenting vote.

ALTERNATING-CURRENT MOTORS.

In the discussion of a paper by Mr. William Cooper on the "Regeneration of Power with Single-Phase Railway Motors," Mr. W. I. Slichter said that the method outlined by Mr. Cooper is exceptionally advantageous for heavy railway work. He showed that the amount of power returned during retardation can conveniently be varied by changing the excitation of the exciting motor. Mr. L. B. Stillwell stated that the most advantageous feature of regeneration is in the minimizing of wear and tear on the rolling stock. Even with three-phase motors, the regeneration is of considerable importance. Thus it is possible with such motors to maintain an average speed equal to that with series-wound motors and yet obtain a large saving in energy. For example, instead of climbing a hill at 20 miles per hour and descending at 40 miles per hour, it is preferable to travel at the mean speed of 30 miles per hour, requiring extra power for ascending and returning power in descending. In reply to a question by Mr. J. A. Lincoln Mr. Cooper stated that when a railway motor is used both for propelling and for braking the wear on the gear is somewhat increased over that dur-

ing simple motor operation, but the increase is not large and is of no importance.

A paper by Prof. C. A. Adams and Messrs. W. K. Cabot and G. Irving, Jr., on "Fractional Pitch Windings for Induction Motors and Alternators," and one by Mr. R. E. Hellmund on the "Zigzag Leakage of Induction Motors," were discussed together.

Mr. B. T. McCormick explained by means of a vector diagram that with a fractional pitch winding the exciting magnetomotive force can be determined by a simple calculation involving the resultant of two vectors displaced from each other by as many electrical time degrees as the upper and lower half windings are separated in electrical space degrees. A similar diagram served to determine the relative increase in the leakage reactance of the embedded conductors when certain turns were placed in slots with turns of another phase.

Mr. C. W. Stone called attention to the fact that fractional pitch windings are quite generally used for motors and generators. With such windings, when high voltages are used, it is necessary to use extra insulation on the windings of different phases that are placed in the same slot.

Prof. Adams showed that the increase in exciting current with a decrease in the winding pitch is due to two factors; the flux density for a certain impressed voltage is increased. while the area over which the magnetomotive force of the current in each winding operates is decreased. Although both the exciting current and the short-circuit current are increased, the maximum power factor may not be the same, because the two do not always increase in the same ratio.

Dr. A. S. McAllister stated that the most convenient method for ascertaining the exciting current is by finding the quadrature wattless volt-amperes. Since the energy stored in any magnetic field during one-half cycle is restored during the next there is a definite interchange of energy from the electric circuit to the magnetic circuit during each half cycle. The amount of energy in each magnetic part depends directly upon the product of its volume and the square of the magnetic density and inversely upon the permeability. The total sum of the cyclically stored and restored magnetic energy per cycle reduced to power by reference to the frequency gives the quadrature exciting volt-amperes, from which the exciting current can be determined when desired.

In the discussion on a paper by Mr. W. I. Slichter entitled "The Vector Diagram of the Compensated Single-Phase Motor," Prof. V. Karapetoff showed that according to the usual theories of the compensated single-phase motor, the current locus should be a circle. Experience, however, shows that the locus is not a true circle, but departs therefrom on account of the change in magnetic reluctance, which change the usual theories fail to consider. While the simple theories are adequate for explaining the characteristics of the motor they are not sufficiently exact for predetermining the performance of a machine being designed.

TRACK SIGNALING.

A paper presented by Mr. L. Frederic Howard on "Track-Circuit Signaling on Electrified Roads," an abstract of which is printed on page 20, was discussed by Messrs. C. F. Scott and H. G. Stott. Mr. Scott outlined the history of the development of the electric track signals. Under early steam road conditions direct current was used for the signals. When track signals were first used on electric railways, one rail was reserved for signal work and direct current continued to be employed for the signal circuits. Subsequently alternating current was substituted for direct current in operating the signals and both rails were used simultaneously for the propulsion current and for the signal current. With the more recent introduction of alternating current for propulsion a separate higher frequency current has been found adequate for operating the signals without interference from the low frequency propulsion current.

Mr. Stott called attention to the fact that signal engineering is a highly specialized branch of electrical engineering requiring an intimate knowledge of the laws of electromagnetism. He stated that the signal engineer deserves a high rank among the members of the electrical engineering profession. All passenger-carrying railroads, whether steam or electric, should be equipped with complete automatic block system; no part of the working of which that may relate to the safety of the passengers should be left to human control.

ELECTRIC POWER TRANSMISSION.

A paper by Prof. F. G. Baum on "Power Transmission Economies" was discussed by Dr. Steinmetz, who showed that "satisfactory operation" is a term the interpretation of which is extremely flexible. Thus a service that would be considered entirely satisfactory for a Western mining community could not be tolerated in a large city. In the case of the former two interruptions of service per month might well be permitted, but in the case of the latter a single short interruption per year would place the power company in bad repute, probably resulting in the permanent loss of business. Prof. Baum's paper deals with conditions under which absolute continuity of service may not be the predominating requirement. It records an economical solution of the problems encountered, but the solution is not general in its application.

"One-Phase High-Tension Power Transmission" was the subject of a paper presented by Mr. E. J. Young. In its discussion Dr. Steinmetz said that in the early days of low-tension transmission, when wooden poles and cross-arms were in use, the limiting factor in the increase in the voltage was the e. m. f. between wires; on the basis of such e. m. f. the three-phase system requires only three-fourths as much copper as the one-phase. Under modern conditions the limiting factor is the voltage between each line wire and the grounded insulator pin; on the basis of this e. m. f. the one-phase system is equally as economical as the three-phase. Much discussion has arisen as to whether the one-phase and the direct-current system should be compared on the basis of the maximum, the effective e. m. f. or some value between these two. In any event, it is not probable that the direct-current transmission system will be used in this country in preference to the three-phase system.

Mr. C. F. Scott expressed the opinion that independent of any advantage in economy in transmission circuits which the direct-current system may possess over the alternating current, the former is objectionable in that means for the utilization of the power received are quite complicated and not so reliable as stationary transformers, induction motors, synchronous motors and rotary converters.

In reply to a question by Mr. E. H. Schwarz, Dr. Steinmetz stated that a one-phase generator possesses a better regulation than a polyphase generator at the same current output per phase, but at the same total power output the regulation of the one-phase generator is much worse than that of a polyphase generator.

The discussion of the above paper concluded the technical portion of the convention programme. Upon motion by Mr. Stott, a hearty vote of thanks was extended to the local committee and the many operating and manufacturing companies for numerous courtesies and extra efforts for the comfort and convenience of the members and their friends.

Another Electrical Show.

An electrical show will be held in New York City, at Madison Square Garden, from Sept. 30 to Oct. 9, inclusive, excepting Sundays. This show is termed "The First Annual Electrical Show," and will be conducted by a corporation formed for the purpose. The preliminary circulars are now out and may be had on application to the management, Electrical Show, Inc., 1212 Morton Building, Nassau Street, New York. A number of prominent companies, it is stated, have already taken space or signified their intention to do so. The New York Edison Company has given the project its support to the extent of taking large space.

The Training of Electrical Engineers.

The following article from the pen of Prof. F. B. Crocker is reprinted from a recent issue of the *General Electric Review:*

This matter, not only from the educational point of view, but also from the standpoint of the manufacturer and other employers of electrical engineers, has occupied much of my time and thoughts for the past 17 years. It is now generally recognized that a course of instruction in some technical school is an almost necessary preparation for entering the electrical engineering profession. Formally this was not so, some men having achieved eminence and many having been successful without this educational training, but the percentage of these cases becomes less and less as time goes on. It is still possible, however, for one to reach high positions in the electrical field, especially on the business side, by rising from the ranks, so to speak, just as one may become a major-general of the United States Army without graduating from West Point. In fact, some of our most prominent army officers of the present day are not West Pointers. It is even desirable, I think, that this opportunity should always remain, not only in the army, but in the engineering professions.

It is natural, however, for the writer to consider the question from the viewpoint of the technical school and perhaps to be prejudiced in favor of it. The present discussion will, therefore, be confined to that form of training.

The advantages that such a training give, may be briefly enumerated as follows:

First: The thorough knowledge gained of fundamental subjects, such as mathematics, physics and chemistry, upon which all engineering is based.

Second: The training is systematic and teaches the student how to think and investigate logically and effectively.

Third: A special and fairly complete grasp is secured of one branch of engineering as well as of the allied subjects. The total time occupied is only four years, while it is doubtful if the same knowledge could be picked up in 10 years outside of an educational institution.

Fourth: The "practical" engineer knows certain branches intimately, but there are other equally important ones about which his mind is almost a blank. This is not usually the case with the educated engineer. The practical man simply learns from experience, and, from lack of opportunity, usually fails to fill in the gaps of his knowledge.

On the other hand, the completeness and correllation of the different branches of scientific instruction make a technical education particularly strong and useful. The principles of science remain unchanged, so that any new invention is intelligible to a scientifically trained mind, but has to be learned as a new subject by a purely practical man. Science has now become so exact that it can be applied directly to practice without great modification, especially in electrical engineering. The apparent contrast or opposition so often pointed out between theory and practice is becoming less and less as both science and practice advance. Technical instruction should be directly based upon correct theory, but should lead up to practical results. Commercial apparatus and methods often give the most excellent examples of scientific principles.

The article by Mr. B. A. Behrend on "Engineering Education," which appeared in the ELECTRICAL WORLD of Jan. 5 discusses this question very fully, and in a manner with which I fully agree. Mr. Behrend makes the following statement which I consider of the highest importance and perhaps the most so of any one of the points involved. He says: "The more theory in college the better. The students cannot receive good practical instruction at college, hence let them get as much theoretical training as possible. Mechanical laboratories are much better than football, but they do not at all take the place of a year's training in a shop."

In an article which the writer published in the *Columbia Engineer,* in May, 1897, it is also pointed out that "it is a fact that technical training does not give a business knowledge and I do not think it should attempt to give anything like a complete business education; it would be out of place and probably futile to do so. There is another thing that a technical education fails to give; that is, knowledge of human nature and the ability to deal successfully with superiors, equals and subordinates." These three points sum up, I think, the principal results that technical training cannot be expected to accomplish. I am in thorough accord with Mr. Behrend in insisting that after all, the inculcation of fundamental principles and correct theory is the real function of technical education, and much more appropriate than an effort to give an imitation of factory and central station methods. The writer does not mean, and I am sure that Mr. Behrend did not mean, that practical matters are to be ignored in colleges, but that the theory should be *real theory,* as he calls it, and should lead up to the practical applications.

Another point which I urge strongly is the importance of not specializing too greatly or too early in technical instruction. It is practically inevitable that an electrical engineer will devote nearly all of his time to the study and work of his profession. His time is occupied with reading electrical journals, letters, contracts, etc., in discussing electrical topics and in handling electrical apparatus. He has little or no time (and this is borne out by the experience of at least nine men out of ten) to study or even consider other branches of science or technology. For example, it is not likely and hardly possible for him to sit down and study chemistry, metallurgy or other non-electrical subjects. It is most desirable, therefore, that a certain amount of such knowledge, at least the fundamentals, should be acquired by him while he is young and has the benefit of systematic instruction. If he does not secure the knowledge then, he is never likely to, and will almost necessarily, either unconsciously or deliberately, dodge any chemical or metallurgical problem that may arise in his experience. The undergraduate student is particularly short-sighted in his views on this subject. He regards any time spent on topics that are not strictly electrical, and directly bread-winning at that, as being wasteful of his valuable time. As a matter of fact, it is not too much to say that the non-electrical instruction which he receives is more important than the special electrical work. This is because he will never have another opportunity to acquire the other subjects, while his whole life will be spent in gaining electrical information.

As a corollary to this conclusion, I would say that it is not desirable for the non-electrical subjects, such as mathematics, chemistry, mechanical engineering, etc., to be taught by electrical engineers or electrical specialists. The latter would naturally look at the subject from their own standpoint and pick out those particular parts which they consider important to the electrical engineer, and would, therefore, narrow his mind and breadth of his information at the very start. Specialization is necessary and it is hard to succeed without it, but it should not begin too early, certainly not in the first year or two of a college course.

If not too much pressed for time and money it is a good thing for a young graduate of a technical school to pursue a year's post-graduate course, which extends and crystallizes his knowledge. In the long run such a man will probably rise higher. On the other hand, some make the mistake of clinging too long to the skirts of their Alma Mater, so that they become unfitted to face the world. Business conditions are very different from the academic. It is advantageous, in fact, almost essential, for the young graduate to serve an apprenticeship of a year or more, preferably in a large manufacturing establishment. This is true even though he intends to become a power plant engineer, contractor or consulting engineer, because he will always have to deal with apparatus which originates in a factory, and it is very important for him to know how it is made. Furthermore, the inspiration and object lesson of a large manufactory are most impressive. There, in a few months, he will get plenty of the "practical" and more of it than he can acquire in as many years in any technical school or college. At every turn he will see and be able to understand applications and embodiments of the principles which he has been taught, without which he would labor under a great disadvantage.

Data on Boiler Efficiencies.

We are informed by the Technologic Branch of the Survey that the experiments now being conducted by the boiler division of the United States Geological Survey fuel-testing plant at St. Louis, Mo., on the nature of boiler efficiencies go to indicate that stationary boilers ought to be made to do 10 to 20 times as much work per unit of heating surface as they do now. This great increase in capacity is to be attained by sub-dividing the heating surface and water streams more finely, by allowing less restriction of the water inside the boilers, and by using high forced and induced draft to put a large mass of gases through the boiler at a very high speed.

Up to the present time there have been only vague ideas among engineers as to what factors influenced the efficiency of the steam boiler portion of the steam generator apparatus so as to cause it to absorb more or less of the heat generated by the combustion. Dr. John Perry, the distinguished mechanical and electrical engineer of England, went into the subject mathematically a few years ago and set forth general conclusions tentatively in his book on the "Steam Engine and Gas and Oil Engines." About a year ago, the government testing plant took up the mathematical investigation of the theory of the steam boiler and of heat absorption, and extended Dr. Perry's theory. For some weeks past, Mr. Walter T. Ray, assistant engineer, acting under the supervision of Prof. L. P. Breckenridge, engineer-in-charge of the boiler division, has been conducting a series of experiments on small multi-tubular boilers dimensioned so to enable the theory to be verified, or modified, or refuted. The boilers are fed with air heated electrically. Dr. Perry's theory states that modifying conditions being omitted from consideration, every boiler will always absorb by convection from the gases passing through it, the same percentage of heat which could possibly be absorbed by any boiler containing water at a given steam temperature. This efficiency is, therefore, independent of the temperature of the entering gases and of the amount of gases flowing through the boiler. Of course, it must be understood that the above statement of the theory is slightly subject to modification even theoretically and more so in practice.

As a practical example, let it be assumed that the water in a boiler circulates with entire freedom, which is an unwarranted assumption, and that its temperature is 300 degrees F.; let the gases enter the boiler at 1300 degrees F., then the difference between the two is 1000 degrees F. Consequently, it would be possible for a boiler infinitely long to reduce the temperature of the gases passing through it to 300 degrees F. Let us assume, however, that the gases leave the boiler at 500 degrees F., which is 200 degrees above steam temperature. The efficiency of the boiler then is 80 per cent, because it has reduced the temperature 800 degrees out of a possible reduction of 1000 degrees.

If the same boiler be supplied with gases at 2300 degrees F., the gases enter the boiler at 2000 degrees F. above steam temperature. Dr. Perry's theory states that this particular boiler will reduce these gases 80 per cent as much in temperature as would a boiler infinitely long; that is, to 400 degrees above steam temperature, which is 20 per cent of 2000 degrees, or to 700 degrees F. It will be noticed that the mass of gases does not enter into consideration at all.

This surprising deduction is being accurately verified by the special division of the Survey, from which it is found, when keeping other conditions the same and when keeping the initial temperature of the gases constant, that the final temperature of the air remains the same, whatever the amount of air sent through the boiler per second. So far the upper limit has not been reached with tubes clean inside and out, although the rate of evaporation has already been pushed up to many times that obtained even in locomotive practice.

Perry's theory takes into consideration four fundamental features affecting heat absorption at any point of the heating surface: First, temperature difference between the gases outside any portion of the boiler tube and the water inside. Second, the number of molecules per cubic inch in the gases outside the boiler tube. Third, the specific heat of the gases at constant pressure. Fourth, the velocity of the gases parallel to the heating surface. Of the four above factors, only the first has usually been considered. It will be readily seen that if we increase the temperature of the gases we decrease the number of molecules beating against any square inch of tube heating surface and thus the second factor largely neutralizes the first, especially at high furnace temperatures. The third factor can be taken as constant equal to .24.

The fourth factor is the new and surprising one. Dr. Perry considers that a high velocity of gases parallel to the heating surface scrubs off more or less of the dense film of gases adhering to the metal surface, which film of gases, has already become cold by proximity to the metal. The higher the velocity of gases the more the scrubbing effect, and consequently the greater the amount of heat transmitted. This theory necessarily assumes that the ability of the metal to transmit heat is practically infinite, and when we consider that we ordinarily never put through a boiler tube more than 1/1000 of heat it could possibly carry, it will be realized that this assumption is warranted.

Dr. Perry's theory and the Survey's verification of it will result in placing the steam boiler on a fairly secure mathematical basis. Thus far the experiments check out the theory excellently. The theory and results will be embodied in a special bulletin to be published in two or three months.

The Central Station Business Problem.

In an address before the recent annual meeting of the British Municipal Electrical Association, President S. E. Fedden dwelt at some length on the subject of methods of central station business getting. The position of electricity supply undertakings is, he said, in many respects similar to that of the cultivator, who, by stress of competition, finds himself no longer supported by the natural production of his holding and must resort to methods of fertilization, in doing which he is soon confronted by the principle of "Diminishing Return" which sets a limit to the amount of capital and energy which he can profitably expend in improving the yield of his land.

"Similarly with the creation of a demand for electrical energy. The first consumers are obtained with little or no difficulty; after a time the rate of increase of connections falls to a low value, perhaps almost balanced by a few disconnections which are unavoidable. Here is the occasion for energetic effort; canvassing, price reduction—direct or indirect—and missionary work among the next circle of possible users. Once more we go ahead and secure new business, but every kilowatt connected this time has cost something to secure. Soon a steady condition is again reached. To move forward once more renewed effort is required; more educating of the public; fresh adaptations of electricity; special terms and concessions must be made to get us moving into the next larger circle of demand, and so on.

"Can we not approach this problem in our own way as we have so many others in the past, and however commercial we become by the decree of modern conditions, yet keep our enterprises free from the taint of mere huckstering? After all, the object in view is to ensure that every likely consumer shall become acquainted with the possibilities of our supply in relation to his business, pleasure, or home life, and that such information shall certainly reach him without any effort on his part. The safest and most efficient means of securing this result are by demonstrations in the form of press records of work done, showroom displays, exhibitions, and the loan of apparatus on approval, and although this method may involve considerable outlay, I think the return would be immeasurably greater than upon any extensive scheme of general advertising alone, moreover, such means inspire confidence and avoid the possibility of creating an exaggerated impression, or

overstating any particular claim. Apart from considerations of business morality, this is a most important point, where the investment by the consumer in electrical apparatus is not the end, but only the commencement of continuaos business relations, which can only be satisfactory and re-act favorably on the undertaking when the results are at least equal to the expectations of the purchaser."

CURRENT NEWS AND NOTES.

ELECTRIC SIGNS IN CHICAGO.—Overhanging electric signs on State Street, Chicago's principal thoroughfare, have been ordered removed by the Commissioner of Public Works.

ADVERTISING SIGNS.—The Rockford Edison Company, of Rockford, Ill., is trying the experiment of advertising in the Chicago daily papers for flat-rate electric sign business. Rockford, these advertisements state, offers an ideal location for this form of publicity.

GIFT TO COLORADO COLLEGE.—General William J. Palmer has given the Engineering School of Colorado College, Colorado Springs, the sum of $12,000, to be expended immediately upon additional equipment of the engineering laboratories for senior work. Prof. Florian Cajori is dean of the School of Engineering, the electrical department being in charge of Prof. J. Roy Armstrong.

LIMITING VOLTAGE OF ALTERNATORS.—In a paper presented last month before the British Institution of Civil Engineers, by Messrs. H. R. J. Burstall and J. S. Highfield, the authors in referring to alternating-current generators say: "We wish to express the opinion that at present it is impossible to construct a machine with closed slots which will work at a pressure of 10,000 volts to earth."

ELECTRIC SIGN SUIT.—A novel suit has been brought by Fred Kuhmmel against the Oliver Chilled Plow Works, at South Bend, Ind., in which he asks $5,000 damages and a perpetual injunction against the defendant in operating an electric sign 200 ft. long on the warehouse of the plant. The plaintiff says the sign, which has over 4000 incandescent lamps and requires 165 horse-power, "turns night into day, produces ill-health and discomfort to himself and family, shakes the house and induces boys and men to congregate about his premises to play ball at night and indulge in revelry."

THEATERS AND TELEPHONES.—Mr. Frohman, the American theatrical impresario, said recently in London: "Two-thirds of the communication in London that two or three years ago was settled by correspondence or calls is now done by telephone. The result is a man's work is more concentrated and he gets more time. In perhaps one hundred or more engagements I might have during the day, half are settled by telephone, even to engaging actors and listening to musical lyrics. I have decided more stage questions this year this way than by correspondence or personal meetings. In fact, I have engaged two star actors and made agreements with three authors for plays without having ever met them."

ELECTRIC FIRE ENGINES.—Leipzig, Germany, has four storage-battery fire apparatuses in the shape of engine, ladder truck and two tenders. All of the machines are driven from the front axles, so that it is possible to turn them even in the narrowest streets. Each machine is equipped with two motors, which can develop from 7 to 14 horse-power. They have five forward and two backward speeds and one electrical and one hand brake. The machines are guaranteed to run a distance of 18.5 miles on one charge at a rate of speed of 15.5 miles per hour, even upon poorly paved streets or upon four per cent inclines. As there are no hills in Leipzig and as the streets are all in good condition, the machines can cover a distance of about 24 miles on one charge.

DEVELOPMENT IN ITALY.—According to dispatches from Italy, the Edison Company of Milan is the head of the largest syndicate ever formed in Italy for the development of electrical power. The new concern, which is capitalized at $5,000,000, plans the construction of hydro-electric plants having an aggregate capacity of about 100,000 hp. The power plants are to be located in the Camonica Valley, in the Brescia district of Northern Italy. The syndicate will furnish electrical energy to operate various traction lines in and around Milan and Como, as well as supply it for industrial operations. The Edison Milan system is one of the earliest to be established on the Continent. Its first engineer was Mr. John W. Lieb, Jr., now associate general manager of the New York Edison system.

FATAL X-RAYS.—It is noted that the death of Dr. Weigel, a surgeon, of Rochester, N. Y., from a disease due to the constant use of the X-rays makes the fourth from this cause in the United States. The others were Dally, an assistant of Mr. Edison, a Boston physician and a woman of San Francisco named Fleischman. In the case of Dr. Weigel, since 1904, when his right hand and all but the thumb and a finger of the left hand were removed, there had been four operations in trying to save his life. The first removed a part of the right shoulder, then a part of the muscles covering the right breast. Mystery completely envelops the cause of death, the disease being unknown to medical science, though it is believed to involve some great principle of life. Dr. Weigel was president of the Rochester Academy of Medicine and the American Orthopedic Society.

HIGH SPEED TRAVEL.—The electric locomotive has a worthy rival as to speed in the automobile. Mr. S. F. Edge, in a six-cylinder Napier motor car, made last week on the new Brooklands track, 1581 miles in 24 hours, at an average speed of 66 miles an hour and reaching at times 72 miles. No man ever before traveled anything like as far, on or off tracks at such speed. The Brooklands track is 3 miles in circuit. Around the course are sentry boxes, which give full control of the complete circuit. These are equipped with telephones. In the event of an accident or a breakdown, the sentry in the nearest box hoists a flag, rings an electric bell, which communicates with the sentries on either side of him, and then telephones to headquarters in the official buildings for what help is required. A special staff, an ambulance car, and a breakdown gang are always in attendance, for dispatch on telephonic call or otherwise.

A NEW ENGINEERING SOCIETY.—A new engineering society has been organized in Philadelphia, called the Engineers' & Constructors' Club. Membership in this society is limited to the engineers composing the organization of Dodge & Day. Its object is to discuss subjects relating to engineering and construction and to give all members the benefit of the experience gained by each in his particular line of work. Four meetings have been held. Up to date the following papers have been presented and discussed: "Civil Engineering Preliminaries for an Interurban Trolley," by Charles Reed Marsh; "Electric Welding," by J. H. Gravel; "Gas Producers and Internal Combustion Engines," by John E. Zimmermann; "Concrete Piling," by Julian C. Smith. The proceedings of the club, giving the papers presented and the discussions, will be published regularly. The officers of the club are: President, Harold T. Moore; secretary, George Walters; managers, F. C. Andrews, H. F. Sanville, John E. Zimmermann, C. N. Lauer.

ELECTRICAL COURSE AT THE NAVAL ACADEMY.—The board of visitors to the Naval Academy, in its report to the Secretary of the Navy, has recommended that a new department be created for the study of electricity and the practical application of electric power, such department to have at its head a naval officer thoroughly familiar with all the types of electric apparatus intended for use on board vessels, and as many qualified instructors as may be necessary to teach the midshipmen the methods of construction, repair, maintenance and operation of such apparatus; and further, that an adequate equipment be provided for the department and an amount of time be allowed to this study commensurate with its importance, which the board particularly emphasizes.

THE TROLLEY IN SHANGHAI.—Advices from Shanghai, China, state that a feeling of apprehension exists among the foreign residents of Shanghai that serious disturbances will follow the opening of the new electric street railway system, which will be inaugurated in July. For some time the native press has been agitated over the installation of the electric car lines, and frequent articles of a highly inflammatory character have appeared. These have been reflected in the teahouses and in the street talk of the native city, until now a general uneasiness prevades the foreign quarter. The *South China Gazette* in a recent article told the natives that from 5000 to 6000 persons had been killed by the electric railways in Tokio. This absurd item did not tend to reassure the public.

TELEGRAPHERS UNEASY.—The telegraph situation, while relieved to some extent, is not yet quite clear, the operators being still on strike in San Francisco, and, elsewhere "letting I dare not wait upon I would." By invitation of United States Labor Commissioner Charles P. Neill, who came to New York from Washington a week ago to settle, if possible, the strike of the telegraphers against the Western Union and Postal companies in San Francisco, M. J. Reidy, J. Sullivan and S. J. Konenkamp, of the executive committee of the Commercial Telegraphers' Union, had a conference with him. The situation was gone over. The commissioner went back to Washington, but returned again to see President Clowry, of the Western Union Company. Meantime the inconvenience suffered by the people of San Francisco is said to be considerable.

THE TELEPHONIC EAR.—Attention has been called to the results of Dr. N. R. Blegvad's investigations of the ears of 418 women operators in the employ of the telephone company at Copenhagen, Denmark. Each operator attends to from 80 to 120 subscribers. The average calls are 125 an hour, increasing at times to 200. The results of the investigation may be given as follows: Of the 418 girls examined, 47 showed pronounced pathological changes of the ear drum, leaving 371 with a normal membrane. Of these 26.4 per cent showed a retraction of the membrane of the ear used for the receiver. The work does not produce a diminution of the faculty of hearing in healthy organs, neither is this sense increased, but the ear becomes accustomed to its duty and can thus accommodate itself to the conversation. The lower sound limit is higher than in the normal ear, excluding therefore the deepest sounds, while nothing can be stated about the higher sound limit. It could not be demonstrated that the work had a bad influence upon disease of the ear. But it was found that sudden noises, including that of thunder, could induce a recurrence of a chronic malady or produce a new disease. On the other hand, it was found that the work gave rise in nervous girls to headaches. Thus it would appear that the occupation of telephone operators is about as healthful and suitable for young women in good health as any other. If nervous subscribers would not cultivate the habit of communication, there would ensue a telephonic millennium.

PUBLIC UTILITIES COMMISSIONS.—Announcement was made last week at Albany of the men selected by Gov. Hughes for places on the two commissions created under the New York Public Service Commissions act to take the place of the State Railroad Commission, the State Gas Commission, and the Rapid Transit Commission of New York City. The vice-commissioners were actually appointed and assumed office on Monday, when the law went into effect. The commissioners are as follows: For the First District, which takes in New York City; William R. Willcox (Rep.) of Manhattan, chairman; William McCarroll, (Rep.) of Brooklyn; Edward M. Bassett, (Dem.) of Brooklyn; Milo Roy Maltbie, (Ind.) of Manhattan; John E. Eustis, (Ind.) of the Bronx. For the Second District, comprising the rest of the State: Frank W. Stevens, (Rep.) of Jamestown, chairman; Charles Hallam Keep, (Rep.) of Buffalo; Thomas Mott Osborne, (Ind. Dem.) of Auburn; James E. Sague, (Rep.) of New Hamburg; Martis S. Decker, (Dem.) of New Paltz. The salary of the new commissioners is $15,000, and their term of office five years, but a system of rotation is provided by which one of the present commissioners only is appointed for five years and the others for four, three, two, and one year, respectively, so as to insure continuity. They are removable by the governor upon charges without the consent of the Senate. Each of the commissions will have the selection of a counsel at $10,000 a year and a secretary at $6,000. It is said that the governor had no fewer than 375 names under consideration for the commissions. None of the men named above are known prominently in connection with public utilities except Mr. Maltbie, who is regarded as a rampant "municipal ownership man." Mr. Eustis is a director of the Babcock & Wilcox Company. Mr. Sague is a railroad man and a graduate of the Stevens Institute of Technology. Mr. Decker was once a telegrapher.

MONORAIL IN JERSEY.—According to the newspapers, three of the New York Rapid Transit Commissioners who went out of office on July 1 have become interested in a project to build an elevated, four-track monorail road between Jersey City and Newark, with the intention of carrying passengers from New York to Newark for 5 cents, and from New York to Jersey City for 3 cents. A successful trial of the new monorail scheme has been made, it is said, in the Exposition grounds at Jamestown. The details of the new organization which is to build the road and the exact route the road will take are withheld for the present, but it was ascertained definitely that John H. Starin, Charles Stewart Smith and Woodbury Langdon are to give the new company the benefit of their experience. Mr. Starin, who is vice-president of the Rapid Transit Commission, expresses his unbounded faith in the enterprise generally and in the invention of the new monorail. Mr. Smith and Mr. Langdon are also members of the commission. The system is that of Mr. Howard H. Tunis, an engineer of Baltimore, Md. Briefly stated, the system consists of a long, somewhat narrow, cigar-shaped car, running on two trucks of two wheels, set tandem, each over one rail. Overhead the car is supported by an equilibrium device which holds the car upright under all possible conditions and at the same time acts as a conveyor of the current, doing away with the third rail. By reason of this device it is possible to operate extremely light cars over an extremely light structure. With such cars, the inventor and others claim that 100 miles an hour can be made easily. Supported above the car by iron bents on each side of the track are two small L-shaped rails about 30 ins. apart. The equilibrium device consists of a ladder-like trolley pole arrangement, at the end of which there are ball-bearing guide wheels that run on the L-shaped rails. The trucks on which the little wheels rest cannot be removed from the rails without taking the structure apart, so that there is no chance of the wheels "jumping" and letting the car topple over sidewise. The body of the car is of standard construction, 47 ft. long, 6 ft. wide, and the car is provided with 8 motors.

The Generating Station for the Taylor's Falls-Minneapolis Transmission System.

THERE has recently been put into operation at Taylor's Falls, on the St. Croix River, 40 miles from Minneapolis, a water-power plant of a present capacity of 10,000 kw and an ultimate capacity of 20,000 kw. It has been erected for the purpose of supplying power to the Minneapolis General Electric Company, which is the central station company of Minneapolis.

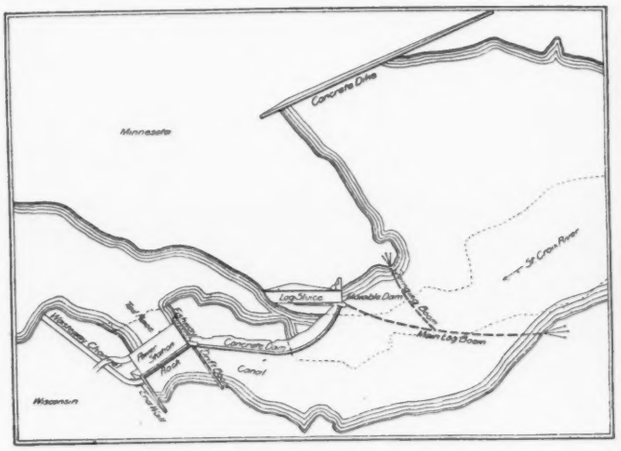


FIG. 1.—MAP SHOWING WORKS AT THE TAYLOR'S FALLS WATER-POWER DEVELOPMENT.

This water-power plant and the transmission line and distribution system connected with it are among the notable recent engineering works of the country. Its capacity is sufficient to take care of all the present electric light and power business in Minneapolis. The purpose of this article is to describe the water-power development of the falls.

Taylor's Falls, on the St. Croix River, are located 40 miles northeast of Minneapolis. The St. Croix River forms the boundary line between Wisconsin and Minnesota at that point, the village of Taylor's Falls being on the Minnesota side of the river and that of St. Croix Falls on the Wisconsin side. The power station is on the Wisconsin side.

HYDRAULIC DEVELOPMENT.

The St. Croix River is an excellent stream for water-power purposes because, as can be seen from a map, it is fed by many lakes which act as storage reservoirs. The dam at Taylor's Falls is 50 ft. high and 740 ft. long. A much shorter dam would have been sufficient to obstruct the flow of the river, but this length was given to provide a long spillway for flood waters. A map of the dam, power plant and river in the vicinity of the falls is shown in Fig. 1. The original course of the stream is shown by the dotted lines, the river being naturally very narrow at this point.

The power station is located on what was formerly a point of land, excavation having been made for the tail-race. By virtue of the tail-race excavation an effective head of 56 ft. is obtained, although the dam is only 50 ft. high. The location is almost an ideal one for the development of large power and storage capacity without excessive flooding of upstream land. The St. Croix River runs between high, narrow banks for the entire 11 miles up-stream influenced by this dam. The only construction work which had to be done to prevent overflowing extensive land was the building of a concrete dike on the Minnesota side of the river, as shown in Fig. 1. Eleven miles above Taylor's Falls is Never's Dam, owned by the same company and maintained for the purpose of storing water with which to supply the Taylor's Falls power plant in dry seasons.

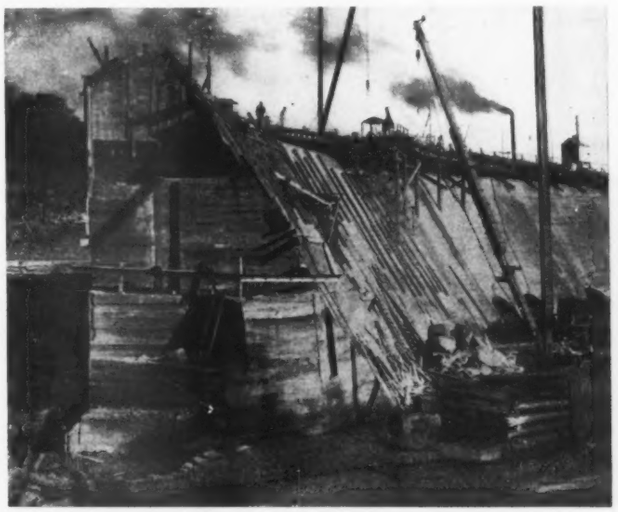


FIG. 3.—DAM UNDER CONSTRUCTION, SHOWING SECTION.

FIG. 2.—GENERAL VIEW OF DAM AND POWER HOUSE AT TAYLOR'S FALLS.

The bill authorizing construction of the Taylor's Falls dam was passed by Congress in February, 1903. It provides for the maintenance of a lock should the government ever desire to open the stream to navigation. The lock, if ever built, is designed to be cut through the Minnesota side of the river.

Fig. 2 shows the dam and the power station as they appeared

soon after completion in January, 1907. As seen by the map (Fig. 1), provision has been made for a log sluice on the Minnesota side of the river, entrance to which is through a bear-trap dam. A log boom extends across the river so as to divert logs to the sluice, and a swinging boom protecting the sluice is also placed above the bear-trap dam. A fish-way is placed at one end of the power station, as indicated.

Fig. 3 is from a photograph taken of one end of the dam while it was under construction. It is simply a piece of solid concrete

FIG. 4.—FOREBAY, WITH RACKS.

construction resting on bed-rock. The rock used in this construction was obtained on the spot. In many cases large chunks of trap rock were cleaned, dropped into place and surrounded by concrete, 6 ins. on all sides. The concrete used in the dam was a mixture of one part cement, three of sand and five of crushed stone from trap rock found on the place. Samples of each carload of cement were tested at the construction office at the falls. The first part of the dam was built with openings in the bottom through which the river was diverted by a cofferdam when the remaining portion of the dam was being built. The forebay is protected by a drift boom located as shown in Fig. 1. Fig. 4 is a view of the forebay showing the ice and drift racks, which are easily accessible to workmen with rakes. A crane has been left in position for the purpose of lifting heavy driftwood out of the forebay if necessary. The dam proper extends clear through under the power house, and the power house building is erected on the face of the dam. Fig. 5 shows a cross-section of the dam at the power house, the power house foundation, showing the position of the intake pipe, turbines and draft tubes. The intake pipe, 14 ft. in diameter, has an elbow leading into the turbine casing. From the top of this elbow a 3-ft. air vent pipe is led off. Over the middle of the turbine casting is an opening through which parts can be hoisted out for replacement or repairs. As will be seen from the cross-section drawing of the power house (Fig. 6), there is an I-beam on the ceiling of the wheel gallery which is located directly over this opening into the turbine casing. This I-beam carries an electric traveling hoist which can be run over any one of the turbines while repairs are going on, and with it parts can be carried to the end of the power house. From the turbine casing two draft tubes 7½ ft. in diameter drop to the tail-race.

POWER HOUSE.

Before proceeding to a description of the gates, gate-operating machinery and turbines, the general arrangement of the power

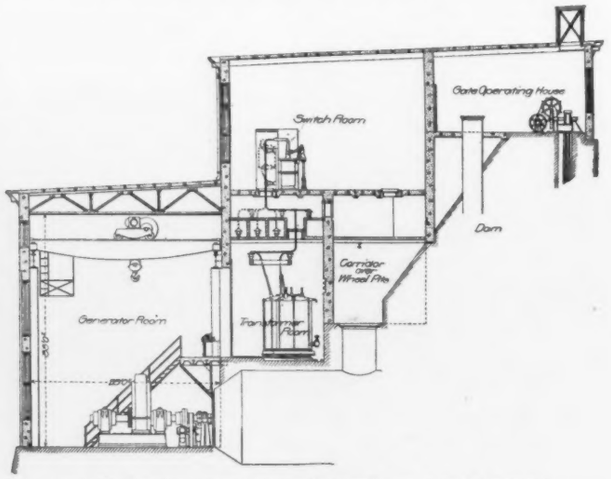


FIG. 6.—CROSS-SECTIONAL ELEVATION OF POWER HOUSE.

station will be considered further. On the lower floor is the generator room, spanned by a Niles-Bement-Pond 25-ton, 3-motor crane. Fig. 6 is a section of the power house through one of the main generators and a transformer. On a kind of gallery or the second floor are the transformer rooms and switchboard. Each bank of three transformers is in a separate fire-proof room and arranged to roll out onto the gallery under the main crane. On the same floor as the transformers, but separated from them, is the operating switchboard located so that the attendant can see from the gallery what is going on in the generator room. The 50,000-volt leads from the transformers go up through the floor to oil switches and then into bus-compartments in a cell room. From the cell room the 50,000-volt conductors pass up to oil switches and from there to the protective apparatus and out to a steel tower, from which a span is made across the river to connect it to the pole line to Minneapolis. Half of the oil switch room is at present vacant, this space having been left for future development.

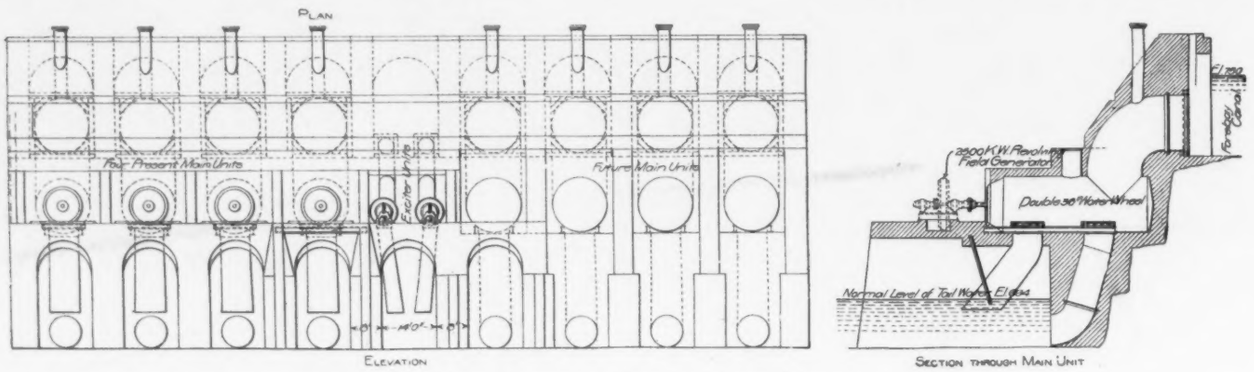


FIG. 5.—CROSS-SECTION OF DAM AT POWER HOUSE.

In the uppermost story of the power plant is the motor-operated gate-lifting mechanism.

TURBINES.

There are four Victor turbine units made by the Platt Iron Works Company, each direct-connected to a 2500-kw generator. Each of these turbine units has four runners 36 ins. in diameter

mounted on the same shaft. At 277 r. p. m. the turbines are rated at 4200 hp with 55-ft. head; at 48-ft. head, 3400 hp; at 45-ft. head, 3150 hp. The runners are removable in the manner described in the general arrangement of the power house. The penstock leading to each set of turbines is 14 ft. in diameter and the two draft tubes 7 ft. in diameter, the total effective head being 55 ft.

The water wheel speed is regulated with Lombard governors, these governors controlling the gates with oil pressure. The oil-pressure tanks for the four governors are connected in multiple. The wheel units can be started, stopped and controlled from the switchboard by small motors mounted on the governor heads and so connected as to raise or lower the running speed of the governor. These governors were installed under a guarantee that an instantaneous variation of 20 per cent in the load on the generator should not cause more than 2 per cent speed variation, and that only for four seconds. In the case of the opening of a short-circuit on the generators the speed is guaranteed not to change over 12 per cent and to return to normal within 7 seconds or less.

The two turbines which drive the exciters have each a runner 18 ins. in diameter. These turbines are rated at 200 hp, at 525 r. p. m. with 55-ft. head. Besides being direct-connected to an exciter, one of these turbines can be connected through a friction drive to an American Fire Engine Company rotary fire pump for fire purposes. The friction drive is of the grooved pulley type.

GENERATORS.

There are now installed four 2500-kw Westinghouse three-phase, 60-cycle, 2300-volt generators. The power house has room for one more generator of this size at the end now occupied by the machine shop, and by extending the building, three additional generators can be installed, making a total capacity of eight 2500-kw machines, or 20,000 kw. The generators are guaranteed to take a load of 2500 kw continuously and a load of 3125 kw for two hours without exceeding the usual allowable temperature rise. Although their normal speed is 277 r. p. m., they are calculated to withstand 554 r. p. m. without excessive strain. If driven at constant speed the drop in voltage between no load and full load with constant field excitation is 6 per cent. The field excitation current is 225 amperes at 125 volts. The efficiency at full load is 96 per cent; at three-fourths load 95 per cent, and at one-half load 93 per cent. The field puncture test is 1500 volts and the armature test 5000 volts.

The two waterwheel-driven exciters are 100 kw, 125-volt machines, direct-connected to the water wheels before described. These exciters, which have an overload capacity of 150 kw for two hours, are compound-wound with a series winding sufficient to maintain constant voltage from no load to full load; or, in other words, a flat characteristic. Their effective voltage can be varied by the rheostat between 90 and 130 volts. The efficiency at full load is 90 per cent; one-fourth load 80 per cent, and at 50 per cent overload, 89 per cent. In Fig. 7 is seen a general interior view of the generator room, showing the machines just described, one of the exciters, however, not having been installed when this view was taken. As seen on the plans (Fig. 8) room has been provided for the installation of a 100-kw motor-driven exciter between the two other exciters when the power house is extended.

FIG. 7.—GENERAL VIEW OF INTERIOR OF TAYLOR'S FALLS POWER PLANT.

TRANSFORMER ROOMS.

The transformer rooms or cells are among the most interesting features of the plant. The doors opening into these cells can be seen at the gallery on the right in Fig. 7 opposite

each generator. There is one bank of transformers for each generator, and ordinarily a generator and its bank of transformers are considered as a unit, although provisions for separating them are made in the wiring scheme of the station, which of the transformers can be run out onto the gallery, where it can be picked up by the traveling crane.

On the top floor of the building is an electrically-heated oil-treating tank 4 ft. in diameter x 8 ft. long, in which enough

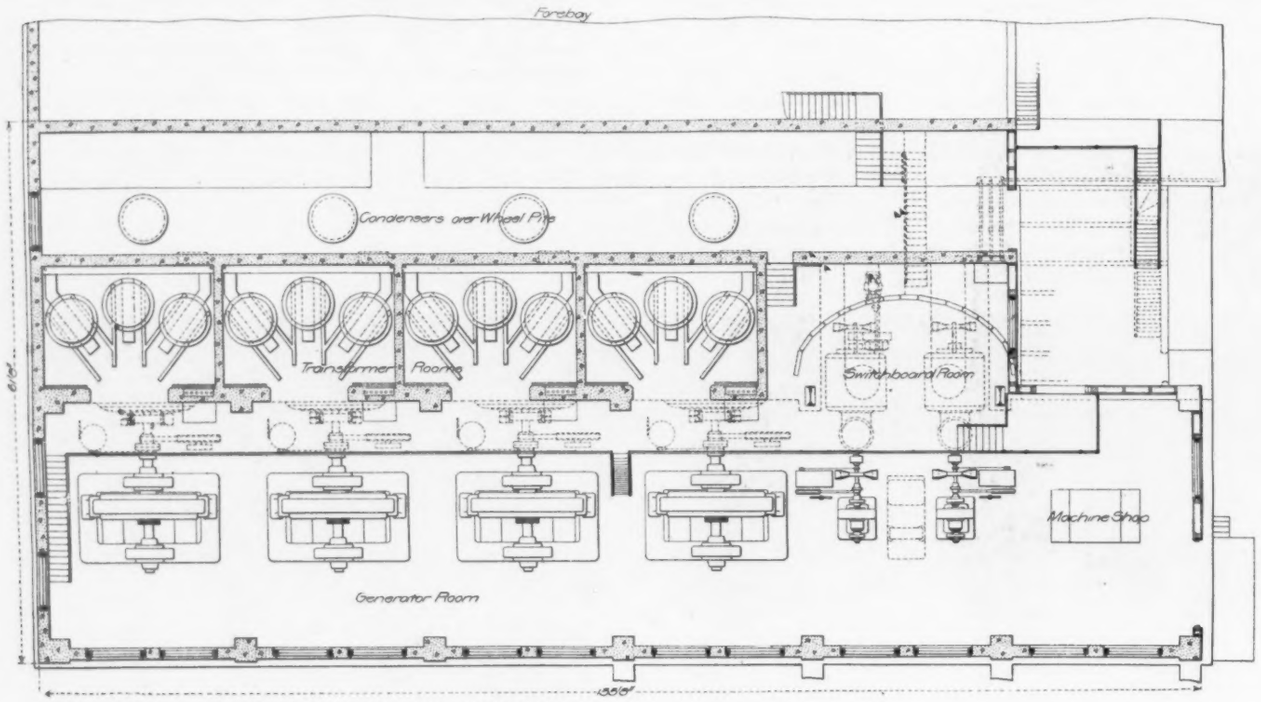


Fig. 8.—Plan View of Taylor's Falls Power House.

will be described later. A view into one of the transformer cells is shown in Fig. 9. The transformer cells are of solid concrete with a fire-door opening onto the gallery in front. The fire-doors are held open by fusible links to allow the doors to slide shut in case of fire. The transformers are each of 900 kw. The primary voltage is 2300 and the secondary voltage 50,000. They are oil and water cooled, the water being piped from the forebay. The oil can be drained from the transformers by opening a valve which is accessible in the wheel gallery behind the transformer cells; thus, in case of fire in a oil can be treated for one transformer. It contains electric heating coils requiring a maximum of 45 kw. When the oil is heated with these coils a motor-operated vacuum pump 8 ins. in diameter x 6-in. stroke pumps out the steam that may be formed from any moisture in the oil. The power station is piped for transformer and switch oil.

Switches and Wiring.

Each generator is connected directly to its bank of step-up transformers without the intervention of any oil switch, al-

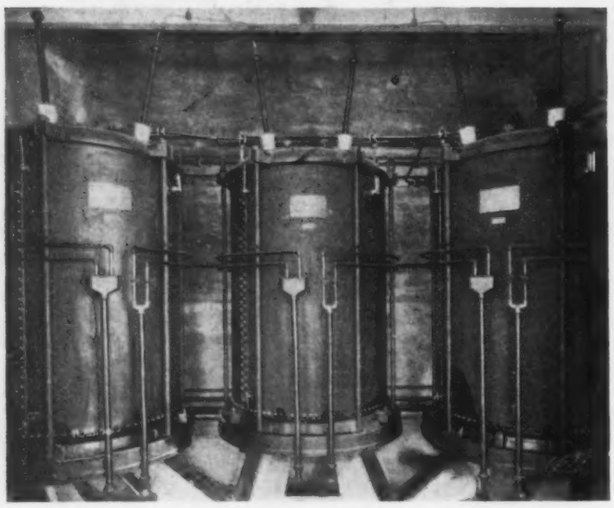


Fig. 9.—View of a Transformer Cell and its Equipment.

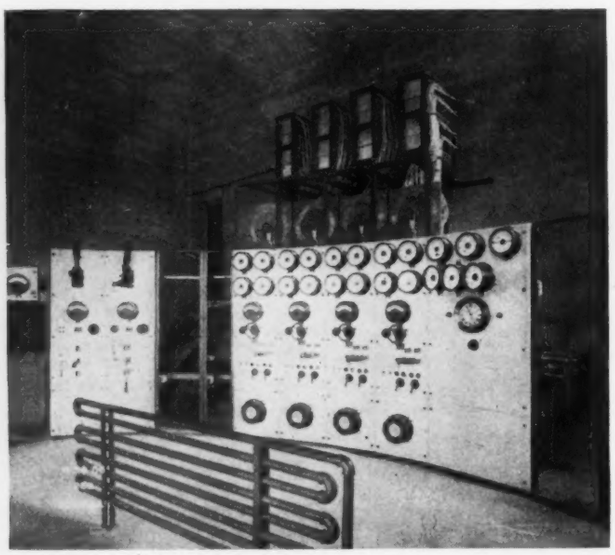


Fig. 10.—Switchboard.

transformer case, the oil can be drained off without entering the cell and the cell can be kept closed. As shown in Fig. 9, each transformer is mounted on a four-wheeled truck and there are tracks converging toward the door so that any one

though there is a set of disconnecting switches in the leads of each generator before they come to the current and potential transformers. In ordinary operation generators are connected in parallel by means of the oil switches on the 50,000-volt side of

the transformer, thus putting them in parallel on the 50,000-volt bus-bars. The 50,000-volt bus-bars are therefore the usual operating bus-bars of the station. One set of 2300-volt bus-bars is operated, however, and branches from the leads of each generator are taken to oil switches, by which each generator can be connected to the 2300-volt bus-bars. These 2300-volt bus-bars are ordinarily intended for use in supplying 2300-volt current in the vicinity of the power plant. They can also be

FIG. 11.—50,000-VOLT, 500-AMPERE OIL SWITCHES.

made a means of connecting a generator to a bank of transformers other than the one to which it is normally connected, as might be necessary in case of the break-down of a generator and a bank of transformers, connected to another generator. The wiring scheme is designed for the completed power station; but not all of the circuits have as yet been installed. There is now a single set of 50,000-volt bus-bars. Provision is made for a double set of 50,000-volt bus-bars and an extra set of switches whereby each generator can be connected with either set of bus-bars. Static dischargers are connected between the generators and transformers, being located in the transformer cell rooms. While provision is made for two out-going 50,000-volt transmission lines, at present there

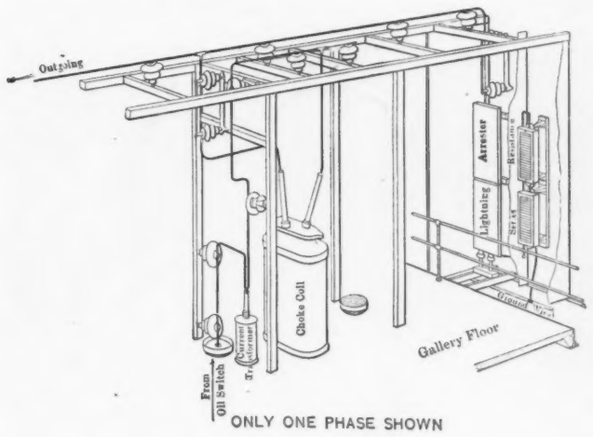


FIG. 12.—GENERAL ARRANGEMENT OF APPARATUS FOR ONE PHASE OF THE 50,000-VOLT LINE.

is only one such line. There is an oil switch between the 50,000-volt bus-bars and the line.

The 2300-volt leads from each generator are carried in fibre conduit in the floor to recesses or cabinets in the wall at the right in Fig. 7. In these cabinets are the current and potential transformers from which low-tension wires are taken to the instruments on the switchboard in the gallery, Fig. 10. The generator leads then pass up to the primaries of the step-up transformers in the transformer cell rooms above. The 50,000-volt secondary leads of these transformers are connected in delta in the transformer room and then pass up through circular openings in the floor, filled with plate glass, to the bus-bar cells or compartments to which a part of one floor of the power station is devoted. From the bus-bar cells the wires lead up through similar circular floor openings to the 50,000-volt oil switches.

The oil switches (which have a capacity of 1500 amperes at 50,000 volts) are considerably larger than are needed in this plant. They were originally built for another plant, but were sent to Taylor's Falls because of the urgency of delivery. They are solenoid operated and in reality consist of three enormous single-pole oil switches mechanically connected. At the right in Fig. 11 is seen the row of holes left for the high-tension conductors to the second set of 50,000-volt oil switches. The other openings in the floor are recesses left for oil piping. From the oil switches controlling each bank of transformers the conductors pass down again to the 50,000-volt bus-bars. In the case of the oil switch connecting the 50,000-volt bus-bars to the transmission line (which is seen in the foreground in Fig. 11) the wires pass up from the oil switches to the series transformers and choke-coils and thence out of the building. The general arrangement of current, transformer, choke-coil and lightning arrester for one phase of the 50,000-volt line is shown in Fig. 12, while the installation as it appears in full is shown in Fig. 13. Hook disconnecting switches are provided on each side of all high-tension apparatus to provide for its isolation in case work is being done upon it.

The operating switchboard is comparatively small and simple, all of the operating switches in the main circuit being designed for remote control by low-tension circuits. These low-tension circuits are obtained from the exciter. The exciter panels are the two at the left end of the board, shown in Fig. 13. There are two negative exciter bus-bars, one of which is for local miscellaneous use in the power house and the other for the field excitation. There is one common positive bus. Each exciter has simply a double-throw, single-pole switch for connecting it to either negative bus-bar and an automatic circuit-breaker. The totalizing panel for the board is shown at the right in Fig. 10, and forms the center of what is to be ulti-

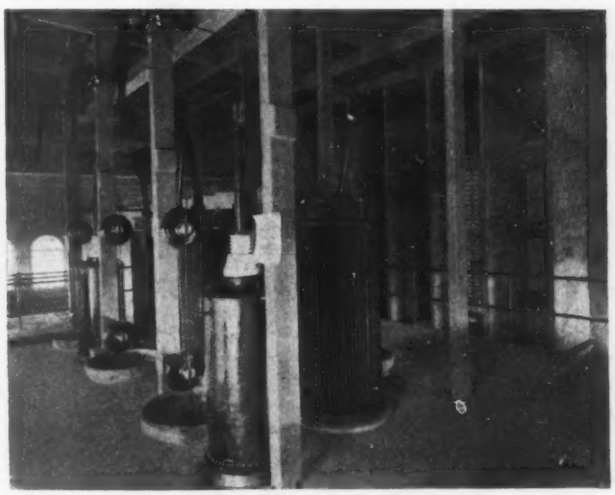


FIG. 13.—STATIC INTERRUPTERS AND SERIES TRANSFORMERS ON 50,000-VOLT LEADS.

mately a semi-elliptical arrangement of switchboard panels. This totalizing panel contains an indicating wattmeter which, by means of a commutating switch, can have its connection changed, so that when the load is light, almost a full scale reading can be obtained, applying, of course, the proper constants to the reading to give the correct result. The other fea-

tures of the board are those ordinarily found in such installations.

GATE-LIFTING MECHANISM.

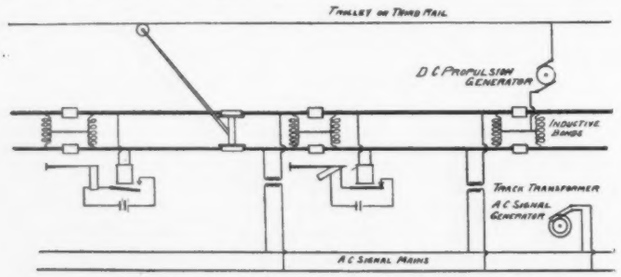
The main gates which admit the water from the forebay into the penstocks are raised and lowered by a motor-operated mechanism. The location of this mechanism is shown in Fig. 6. A motor mounted on the ceiling drives a shaft that runs the length of the power house. From this shaft is driven a countershaft at each gate. This countershaft has a worm-gear-driving pinions engaging in racks on the gate. It is, of course, intended that only one gate shall be operated at a time. The mechanism for any gate can be brought into operation by throwing in a clutch. The controller for the motor is located on one wall of the building and is connected by a sprocket chain to a shaft which has two hand-wheels at every gate, so that the motor can easily be stopped and started from any point. The height of the water in the forebay is continuously indicated and recorded by a Frieze water-level recorder.

The regular operating force of this station, including both night and day shifts, consists of one chief engineer, two operators and two oilers.

The engineering and construction of the plant were carried out by Stone & Webster, of Boston, who are the general managers of the Minneapolis General Electric Company.

Track Circuit Signaling on Electrified Roads.

In his paper before the recent Niagara Falls meeting of the American Institute of Electrical Engineers, Mr. A. L. Frederick Howard gave a brief outline of the various track circuit signaling systems now in use. There



TWO-RAIL SIGNAL SYSTEM USING INDUCTIVE BONDS.

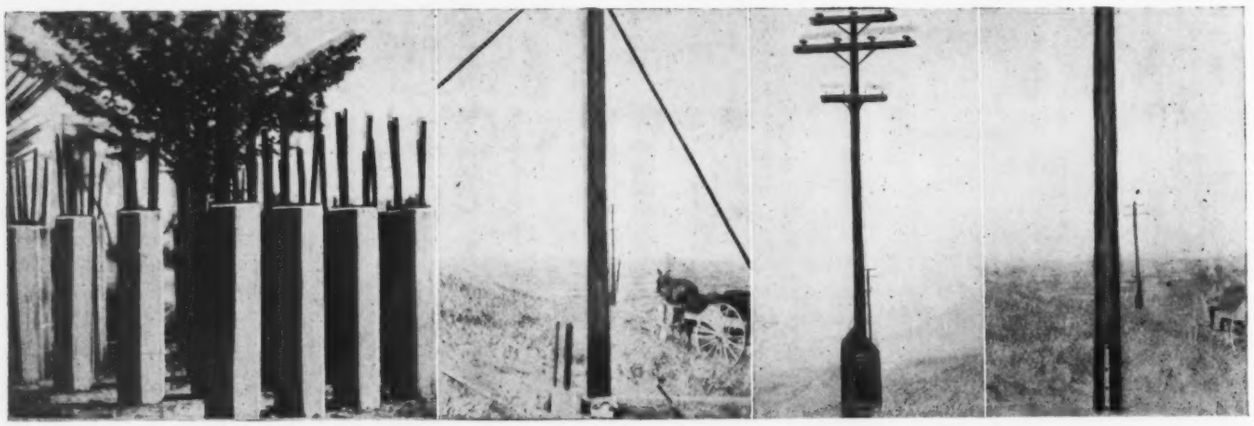
are three distinct types of signals, according to the method of control; namely, the manual or non-automatic, the controlled manual or semi-automatic, and the purely automatic. Train order signals are of the first type; interlocking signals are of the first and second types, while block signals are of all three types. In the early signal circuits use was made of only one wire, which was set apart exclusively to this service, even in cases where such methods necessitated installing additional return conductors for the propulsion current in order to compensate for the rail given up for the signal system. A more recent method allows the use of both rails simultaneously for the propulsion current and for the signal current. A path for the propulsion current around insulating joints is provided for in the latter system in the form of impedance bonds indicated in the accompanying illustration. The propulsion current divides so that each part passes around the iron core of the bond in opposite directions, its magnetizing action upon the core being zero. On the other hand, the full impedance of the bond is offered to the signal current in preventing the passage from rail to rail of the alternating current used in the signal circuits. The principal difference in the relation between the elements of the track circuit as used on direct-current and alternating-current railway systems relates merely to a higher frequency of the signaling current.

Deflocculated Graphite.

Mr. Edward G. Acheson delivered an experimental lecture at the Niagara Falls convention of the American Institute of Electrical Engineers, illustrating the properties of a recently discovered form of graphite. This graphite is produced by adding water, gallotannic acid and ammonia to unctuous graphite as produced in the electrical furnace. Under these conditions the graphite is miscible with the water. It was shown, however, that when plain water is added to unctuous graphite the graphite separates completely from the water when allowed to stand for several minutes. When it is mixed with water, tannic and ammonia the graphite assumes what is called a deflocculated condition, a condition of fineness beyond that obtainable by mechanical means—one approaching the molecular state. Deflocculated graphite in water has been used successfully instead of oil in sight-drop feed oilers and with chain-feed oilers. It possesses the remarkable property of preventing rust or corrosion of iron or steel. The deflocculated graphite has also been successfully employed with kerosene oil as an effective lubricant.

Concrete Bases for Poles.

Mr. M. H. Murray, of Bakersfield, Cal., has recently made a very interesting installation of 150 concrete pole bases for the Power, Transit & Light Company, of that city. This work was actually done while the line was carrying electrical energy at a potential of 11,000 volts. The process of construction is illustrated in the accompanying views. Fig. 1 shows a group of the bases. Fig. 2 shows the pole with the base alongside and with 11,000 volt current on the line, while the operation is going on, without interference with the service. Fig. 3 is another stage, and Fig. 4 shows the pole with the work complete after installing the base. It is obvious that a decayed base can be cut out and removed, therefore, not only in light and power circuits, but with telegraph and telephone pole lines. We understand that a trial installation has also been made at Emeryville, Oakland, Cal., on the line of the Key Route Railway.



FIGS. 1, 2, 3 AND 4.—CONCRETE POLE BASES AND THEIR APPLICATION.

Electric Refrigeration in a Wholesale Produce House.

An interesting example of the use of automatic electric refrigeration supplied on central station service to a wholesale produce house is found in the establishment of George E. Putnam & Son, in Lowell, Mass. This firm conducts a large business in wholesale butter, eggs, cheese, flour, sugar and beans in a four-story and basement building located at 205

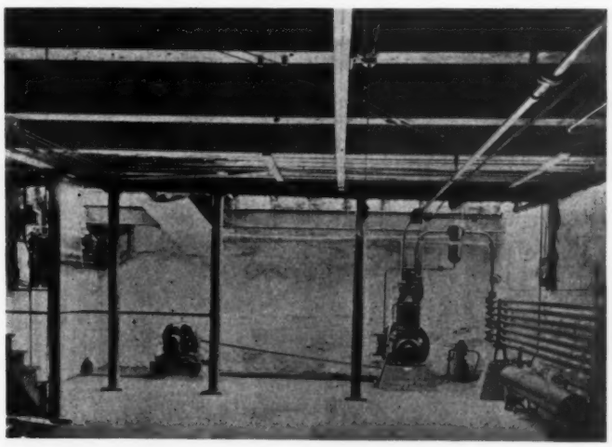


FIG. 1.—GENERAL VIEW OF REFRIGERATING PLANT.

Market Street, Lowell, and in March of this year an automatic refrigerating plant was placed in commission, operated from the mains of the Lowell Electric Light Corporation.

Previous to the installation of the plant the firm depended to some extent upon natural ice for the storage of its perishable merchandise, and to a larger degree upon the facilities offered by a large centralized cold storage organization in Boston. The extra expense of freight and teaming the butter in particular amounted to about $5 per ton. Lowell is about 26 miles from Boston, and with a double teaming at the Boston end or re-shipment by slow freight to Lowell in less than carload lots and drayage from the Lowell freight depot to the wholesale house, the conditions were unfavorable to economical handling between the dairy and the store. Sometimes 10 per cent of the firkins were found to be damaged by the repeated jarring and rough handling. These points were strongly influential in the decision to install automatic refrigeration, which included the advantages of greater cleanliness, lower temperatures than are possible with natural ice, independence of the ice supply and flexibility of operation in meeting variable conditions in addition to the reduction of transportation annoyances. Slightly below 40 degrees Fahrenheit was the lowest temperature which the firm was able to secure with natural ice.

The establishment occupies all the floors of the building, but no refrigeration is required on the two upper floors, which are at present devoted to the storage of flour and beans. The refrigerating machinery is located in the basement, and it consists of a 10-ton compressor (with normal back pressure) cylinder 5⅝ in. x 8 in., belt-driven by a 10-hp 500-volt General Electric direct-current motor making 800 r. p. m. The plant was supplied by the Automatic Refrigerating Company, and its particulars in the main conform to the usual practice of that company, including in this instance a 7-pipe condenser of the double-pipe counter-current type, automatic thermostat and motor starter, etc. The direct expansion coils are all of extra heavy 1¼-in. wrought iron pipe electrically welded and tested to 300 lbs. per sq. in. before shipment. In this plant an air pressure test of 275 lbs. was applied before introducing ammonia into the system.

The compartments refrigerated include a storage room in the basement, two rooms on the street floor, and two rooms on the second floor. The basement room is 30 ft. x 12 ft. x 10 ft. in dimensions; it is kept at a temperature of 40 degrees F., and is used as a storage for lard, cheese, etc. A single quadrilateral line of pipe kept at slightly below zero suffices to cool this room. This line is in series with all the rest of the expansion coils in the system, but is provided with by-pass valves. The expansion valve of the system is located in this room. The pressure on the compressor side of this valve seldom exceeds 155 lbs. and on the refrigerating side 10 to 15 lbs.

On the street floor the larger of the two compartments is 300 ft. x 12 ft. x 11 ft. in dimensions, and it is used for the storage of eggs. The house handles a larger quantity of fresh laid eggs than any other in New England. The temperature of the egg room is kept between 30 and 32 degrees by an automatic thermostat installed on the wall, which starts the compressor motor through a relay operated switch and resistance when the temperature rises above 32 and stops it when it falls. Adjoining the egg room is a room 12 ft. x 15 ft. kept at 36 to 40 degrees, and used as a selling room. Only a small quantity of goods is kept here. Expansion coils are provided on both sides of the compartment.

The two refrigerating rooms on the second floor are designed for the storage of butter and each is 16 ft. x 22 ft. x 11 ft. with walls insulated by paper and air spaces. Access to these rooms is had through a vestibule or air lock. These rooms are ordinarily to be run at from zero degrees to 5 degrees F., but on test a temperature of from 7 to 9 degrees below zero was attained. The coils in these rooms are placed on all four sides, extending from the top to within 3 ft. of the floor on 6-in. centers, all joints being welded. In one of the two rooms the coils are divided into two sections controlled by valves on the street floor below. Either coil or both can be operated at once. There is also a second thermostat on the second floor which can be cut in and out of operation by a triple-pole switch downstairs according as it is desirable to transfer the control of the compressor motor from one compartment to the other.

Separate meters are provided for the incandescent, refrigerating and the elevator service used on the premises. Specially shielded lamps are used in examining eggs. The electric elevator is a 2500-lb. Morse-Williams machine driven by a 10-hp 500-

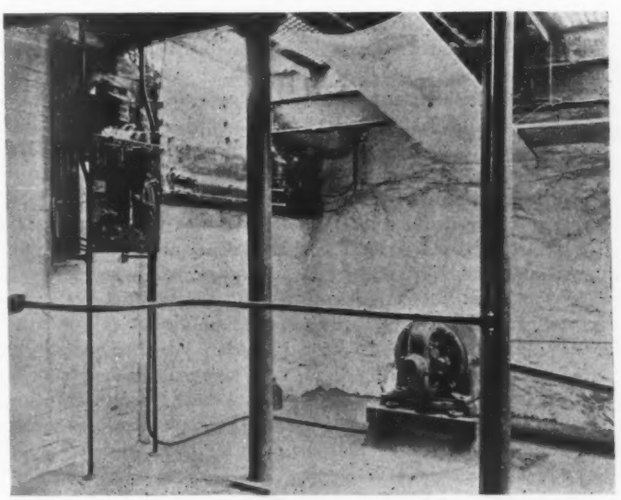


FIG. 2.—MOTOR OF REFRIGERATING PLANT.

volt, 700-r. p. m. Belknap motor. During the 13 years which this motor has been in operation the total cost of repairs has not exceeded $5. The elevator is arranged to receive trucks delivered from loaded cars brought to the house on a special siding and to carry them up or down as is desirable.

The refrigerating equipment proper is mounted on concrete foundations beneath a sidewalk skylight in the basement. A specially attractive rate was made by the central station in view of the desirability of refrigerating loads.

An Electric Plant in the Andes.

By M. R. Suliot.

There are very few plants at an altitude of 14,000 ft. using electrical energy; none, in fact, as large as that owned and operated by the Cerro de Pasco Mining Company. This 500-ton smelter is situated at La Fundicion, Peru, about nine miles from Cerro de Pasco, where the company gets its ore. It is the first in that country to convert its own copper, instead of making high grade matte and shipping it to other countries to be refined.

The ideal source of power for such a plant, where coal costs about $25 per ton, owing to the high freight rates, etc., would be some of the tributaries of the Amazon River, which have

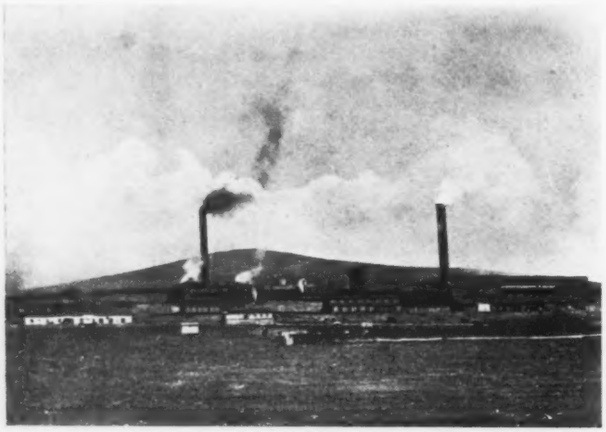


FIG. 1.—SMELTER PLANT OF THE CERRO DE PASCO MINING COMPANY.

their headwaters on this side of the Andes Mountains. Steam power was decided upon, as the development of water power would have taken a long time, and a steam plant is always desirable as supplementary plant. Until recently coal was brought almost entirely from Australia; now, however, the company has acquired coal mines within a radius of 25 miles, from which they take out enough coal to supply their copper mines and shops in Cerro de Pasco, and their smelter with coking and steam coal.

There is a small electric plant at Cerro de Pasco. This is used for feeding lamps in the mines, offices, shops, etc., but the main electric plant is at the smelter, a general view of which is given in Fig. 1.

The electrical equipment in the power house, which is at an elevation of 13,940 ft., consists of one 440-kw, three-phase, 440-volt, Westinghouse generator, direct-connected to a 600-hp cross-compound Nordberg engine, as shown in Fig. 2. For exciting the field of this alternating-current generator, and also for testing and laboratory purposes, a 56-kw, 125-volt, direct-current Westinghouse generator has been provided, which is belted to a 75-hp Nordberg Corliss engine. Both of these sets are to be duplicated within a short time, to meet the increasing size of the plant and also to prevent shutdowns, due to failure of any part of the machinery. In addition to those above mentioned, there is a 75-kw, three-phase, 2300-volt generator, belted to a 100-hp American Ball engine. This voltage is stepped down by three transformers to three-phase, 440 volts, the voltage of the large generator and motors.

This last generator was used to run the machine and blacksmith shop motor, during the construction of the plant and also to furnish energy before there was enough night load to justify running the large generator.

For the controlling of these three sets, there are a two-panel General Electric switchboard, consisting of one generator and one two-circuit feeder panel, and a six-panel Westinghouse switchboard, consisting of one Tirrill voltage regulator panel, one exciter, one generator and three feeder panels.

This completes the electrical part of the power-house equipment, with the exception of two 7½-kw transformers, which are used for stepping down the 440 volts to 110, for the arc and incandescent lamps used throughout the building and throughout the boiler house.

The constant-speed motors used by the company are all of the Westinghouse three-phase, 440-volt induction type, with the standard squirrel-cage type of secondary. The 100-hp motors are started with an oil-immersed auto-starter, consisting of a six-point controller and two separately mounted auto-transformers, for cutting down the voltage in starting. The motors under 100 horse-power are started also by an auto-starter, the three-point switch being immersed in oil; the auto-transformers are mounted just above the switch, the entire device being contained in an iron case.

For running the crushers, rolls, elevators, etc., in the sampling mill, which is about 150 ft. from the power house, there is a 100-hp constant-speed induction motor, and for running the small sampling and grinding machines there is a 10-hp motor of the same type.

Next and most important is the smelter building, for it is here that the raw ore is taken in on one side and comes out on the other side as metal. For handling the converters, molten matte, etc., there is an electric crane, built by the Alliance Machine Company and equipped with Westinghouse alternating-current induction motors. This will soon be duplicated. The main hoist has a full-load capacity of 40 tons, and the two auxiliary hoists a capacity of 15 tons. Of other motors there are two for hauling converter slag between the pouring ladle and crusher, one for running the turntable on which the converters are lined, and two 50-hp constant-speed induction motors.

One of the latter motors runs the clay mixer, the clay being used for converter linings, and the other is used for running the slag crusher. The slag, after being crushed, is conveyed to the slag bin in an 80 ft. elevator, driven by a 30-hp motor, which is situated near the top of the elevator, while the auto-starter is at the bottom. This arrangement allows the man running the crusher to start and stop the elevator without going near the motor, thereby saving much time and many steps.

The slag from the blast furnaces is carried away from the building in launders, in which there is a stream of flowing water. This mixture of slag and water is carried through a

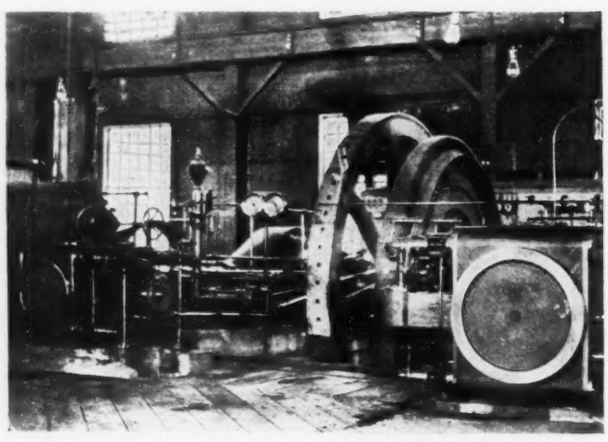


FIG. 2.—VIEW OF MAIN GENERATING UNIT.

series of settling tanks, from which the clear water is pumped back to a tank above the furnace and used again. In this pumping station are two Worthington turbine-type, two-stage pumps, one of which is belt-driven by a 100-hp motor, the other is driven by a 50-hp motor of the same type mounted on the same base and direct connected to the pump, as shown in Fig. 3.

In the coal-washing plant, where all the coal used at the smelter is washed and separated from the slate and other im-

purities, there are two motors of 50 horse-power and 100 horse-power respectively, to drive the crushers, elevators, screens, pumps, etc., necessary in such a plant.

The company has also a very well-equipped set of shops, in which all of the repair work and much of the new work is done. In the foundry is an electric crane, with a main hoist capacity of 10 tons, and an auxiliary hoist capacity of three tons. This crane is of the same general type, built and equipped by the same company as the 40-ton crane in the converter building. For driving the Root blower, elevator, tumbler, etc., there is a 30-hp motor. In the machine and carpenter shops, which are in one building, there are two 50-hp motors, for driving the various machines, while in the blacksmith and boiler shops, which are also in one building, there is a 30-hp motor.

The lighting of the various buildings, including hotels, stores, etc., is mostly done with 110-volt incandescent lamps, there being about 1500 of these in use at the present time. In some of

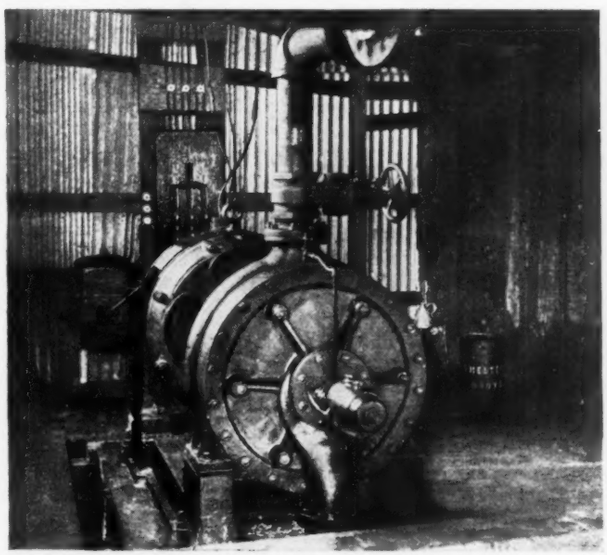


FIG. 3.—MOTOR-DRIVEN PUMP.

the buildings, where more light is required, and also outside among the buildings, Westinghouse alternating-current 110-volt multiple arc lamps are used. The voltage for both the incandescent and arc lamps is stepped down from 440 to 110 volts by means of transformers placed at convenient points over the plant.

While all of the motor and main line circuits where they enter the buildings are protected with General Electric alternating-current lightning arresters, yet it was thought that perhaps the heavy electrical storms prevailing in mountainous regions would affect the apparatus, especially at this high altitude. However, since the first machine was installed, almost two years ago, there has been no damage whatever to the circuits owing to lightning.

The above electrical machinery, which amounts to about 2100 horse-power in motors and generators, with the addition of one of the latest types of central-energy telephone systems, including switchboards, local and long-distance telephones, completes one of the most interesting electrical equipments that can be found in that part of the world. When it is taken into consideration that all of this machinery—in fact, the whole plant—has been put up almost entirely by the native Indians or Cholos, under the direction of white foremen, it makes it still more interesting.

The Cerro de Pasco smelter has been of the greatest use to Peru, inasmuch as it has given employment to the natives at good wages, has given them opportunity to acquire knowledge of various trades, and has called attention most emphatically to the mineral resources of the country.

Electrically-Driven Sewage Pumping Plant at Salem, Mass.

A model electrically-driven sewage pumping plant has recently been placed in service at Salem, Mass., by the Sewerage Commission of that city. The plant is operated by electricity supplied by the Salem Electric Lighting Company at 2080 volts. Salem is located practically at sea level, and the pumping station was built on Cat Cove, at a point on Salem Neck, practically on the harbor's edge, where a 72-in. trunk sewer terminates in a well dropping but one foot below mean low tide water. The sewage has to be disposed of practically as fast as it accumulates. From the pumping station an outfall main, which is a 30-in cast iron pipe, extends into the harbor 9700 ft. to an outlet at Great Haste Island. In order to scour the pipes, the pumps are obliged to force the discharge through them at a rate of 6 ft. per second, or 19,000,000 gals. in 24 hours. This duty is required but about 2 hours per day, so that the pumps are underworked a considerable part of the time. The station is large enough to handle the sewage of the town of Peabody in addition to that of Salem itself.

The problem which the engineers faced in this instance was to take care of 6,000,000 gals. of sewage during 22 hours, and of 19,000,000 gals. during the remaining two hours of each day against minimum heads varying from 7 ft. to 8 ft., according to the height of the tide, and against maximum heads corresponding to the larger and more rapid discharges, varying from 49 ft. to 60 ft.

It was originally expected to operate the station entirely by steam-driven pumps, but the development of the gas engine and the wide-spread popularity of the electric motor drive led the commission to consider all three motive powers. Proposals were secured on the basis of a unit or units having guaranteed duties of 6,000,000 gals. per 24 hours against a head of 18 ft.; of 12,000,000 gals. against a head of 35 ft., and of 19,000,000 against 60 ft. head. The selection of the equipment depended more upon the basis of operating expenses and estimated cost of maintenance than upon the first cost of the plant.

On account of the limited range of speed found in gas engines, the builders of this class of machinery proposed a separate unit for each head, but this worked out so high in first cost that it was later proposed to install four three-speed units, each of 6⅓ million gals. capacity. These units were to be combined to give three duties—a duty of 6⅓ million gals. per 24 hours obtained by running one unit 300 r. p. m., and pumping against a head of 18 ft.; a duty of 12⅔ million gals. obtained by two units running 450 r. p. m. against 35 ft. head; and a duty of 19 million gals., obtained by operating three units at 600 r. p. m. against 60 ft. head—the fourth unit being a reserve outfit.

The steam engine proposition called for two cross-compound units each of 9,000,000 gals. capacity. The speed for the lowest duty was to be obtained by operating one unit with one cylinder cut out, and the higher duties were to be obtained by operating both cylinders and varying the cut-off.

The first costs of the three methods were in the following ratios:

Electric motor drive	1
Gas engine plant	2
Steam plant	3

The floor space requirements were in the following ratios:

Electric motor drive	1
Gas engine plant	3
Steam plant	5

Taking coal at $4 per ton, gas at 75 cts. per thousand ft., and electric power at 1¼ cts. per hp-hour, and figuring all station expenses on a 16-hour basis, the annual operating cost was estimated as follows:

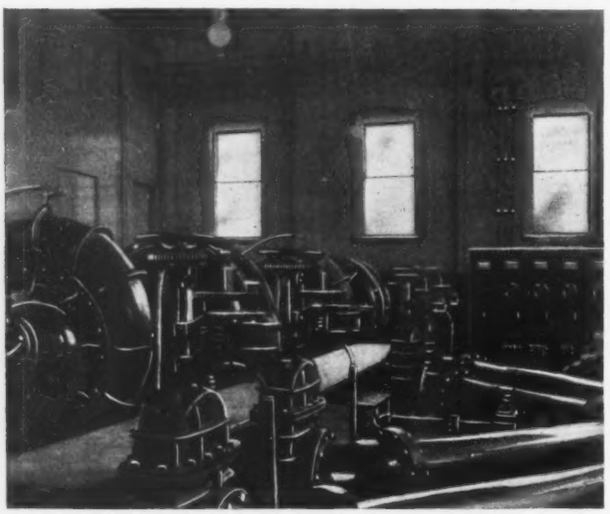
Electricity	$14,000
Gas	15,000
Steam	21,000

The electrical installation was therefore accepted, and the city secured the advantages of greater flexibility, cleanliness and

minimum attendance in addition to the lowest estimate of operating expense. The Salem Electric Lighting Company agreed to supply energy at 1¼ cts. per hp-hour (1⅝ cts. per kw-hour) only on condition that no electricity should be taken at the time of the peak load on the central station, and that the maximum demand for electricity when flushing out the sewer should occur at the time of minimum load upon the generating plant.

The accompanying illustration shows the interior of the pump room, which contains four Worthington horizontal volute centrifugal pumps, each driven by a 12-pole, 125-hp, 600/450/300 r. p. m. 2080-volt, three-phase, 60-cycle induction motor; two Knowles dry air priming pumps, each direct-driven from the lighting transformer of the station by a 5.5-hp, 110-volt General Electric induction motor; four 14-in. Chapman gate valves, one in each main pump discharge pipe, each gear driven by a ½-hp, 110-volt, 1200-r. p. m. General Electric induction motor; one 6-panel switchboard.

Each centrifugal pump motor is equipped with a pole changing controller for speed regulation, and a starting compensator. The illustration shows each motor-driven unit with delivering connection 14 in. in diameter discharging into a pair of Y's which lead into the 30 in. main outfall pipe; the motor-driven



INTERIOR OF SALEM PUMPING STATION.

valves and the switchboard appear in the view. A feature of the station is the admirable accessibility of all the apparatus. As the larger motors carry 2080 volts, a rubber mat is provided on the inspecting platform. The valves may be operated by hand if desired.

The switchboard consists of one 500-hp, 2080-volt incoming line panel equipped with indicating wattmeter, and a General Electric hand operated electrically tripped oil switch, with recording wattmeter on the back of the panel; four main pump motor panels, each equipped with indicating wattmeter, oil type controller, hand-operated alectrically tripped oil switch, and a Chapman automatic switch for operating the main valve motor. A priming pump motor and lighting circuit panel is equipped with ammeter, a lighting circuit switch and two priming pump motor switches, with a hand operated electrically tripped oil switch on the primary side of a bank of three 2-kw transformers for supplying the priming pumps and the lighting circuit. All the controlling mechanism of the station with the exception of the pump motor starting compensator is located at the switchboard, including the valves of the priming system, which was devised by Major J. E. Spencer, chairman of the sewerage board, who had general charge of the entire work. Mr. E. W. Bowditch, of Boston, was consulting engineer for the system as a whole, and the pumping plant was installed by P. B. Patten, of Salem. The installation is an excellent example of a desirable central station non-peak load.

Central-Station Electric Heating Notes from Grinnell, Ia.

The Grinnell Electric & Heating Company, under the management of M. O. K. Cole, has made notable progress in the introduction of electric heating devices. In fact, there are few if any central stations of its size in the country where such a good start has been made in the introduction of electric heating appliances. Grinnell is a college town, the population of which is practically the equivalent of about 5000, although the last census (which, of course, did not include the student population, which is in town nine months of the year) gave the town about 4600.

THE PRESENT CONNECTED HEATING LOAD.

The progress that has been made with electric heating devices so far is shown by the following figures: Electric flatirons in service, 235; complete electric cooking outfits in service, 6; complete electric cooking outfits under contract, 4. Besides this there are a lot of electric cooking appliances in homes which do not have complete outfits. Few, if any, central stations in the country can make such a showing per capita of population. It will be of value to go into the Grinnell situation thoroughly because conditions there are approximately similar to those in many other towns, and the company at Grinnell is setting an example which must be followed by many other small companies in the course of time. There is no gas plant in the town, and if the central-station company keeps up its active work in electric heating there will be no occasion for a gas plant, even should the town grow rapidly in the next few years. The conditions in a town of this kind are most favorable to the introduction of electric heating. There is no competition with gas, the cheapest cooking fuel known. Gasoline stoves and coal ranges are the only competitors found. The gasoline stove is well recognized as dangerous, and the trouble with filling and starting a gasoline stove is against it. Besides this, such stoves are very susceptible to drafts, and the kitchen must be kept fairly well closed to avoid blowing out the flame. With coal stoves there is the nuisance of taking care of the fire, and the heat in summer. A prosperous town like Grinnell has plenty of people who are willing to pay for getting rid of the nuisance of coal, wood or gasoline.

LOAD CONDITIONS.

The load conditions on the station are typical of those in many other towns, with the exception that there is probably

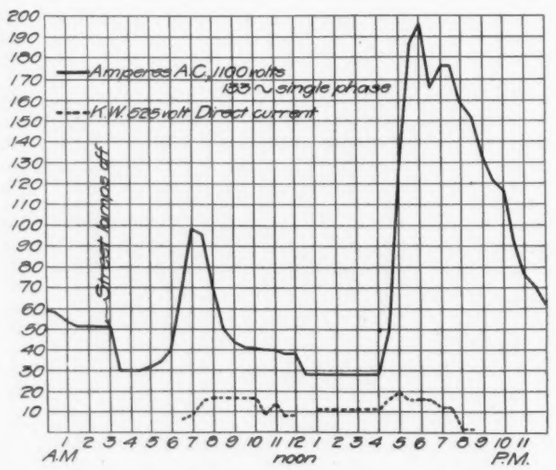


FIG. 1.—GRINNELL LOAD CURVE DEC. 11, 1906.

less manufacturing motor-load than in many other towns, and a better residence load. The station is equipped with high-speed simple engines driving two classes of generators, one a 500-volt direct-current unit, and the other 133-cycle single-phase alternators. Twenty-four hour service is given. During

the winter the engines exhaust into an exhaust steam heating system which, under previous managements, was allowed to grow until it was too large for the amount of exhaust steam that could be supplied by the day load. Several typical load curves for 24 hours are reproduced herewith, Figs. 1, 2 and 3. It will be seen that the day load is very small. The average direct-current load for the year ending in February, 1907, was

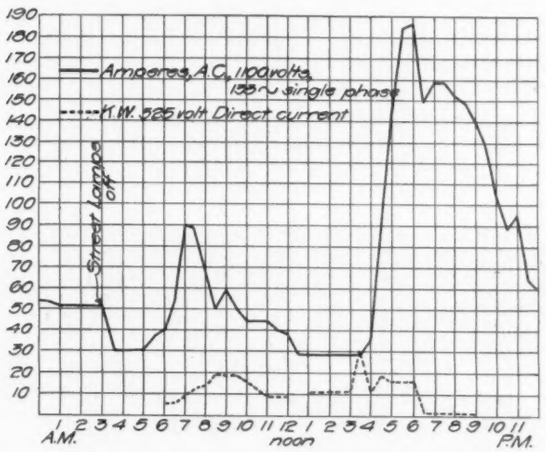


FIG. 2.—GRINNELL LOAD CURVE, DEC. 12, 1906.

5.9 kw, and the average alternating current load 36 kw, this figure being determined by dividing the total output for the year by the number of hours in the year. The peak load was 239 kw, and the load factor for the station about 17 per cent for the year. Now, the company has already exhausted most of the possibilities for motor load, as it is furnishing motors to drive nearly every industry in town except where steam is needed for manufacturing purposes, although there will doubtless be opportunity to pick up a little more power load from time to time, and the city water pumping is yet to be secured. The increase in commercial lighting load being purely peak business, would not result in better earnings on the investment, nor would it help furnish exhaust steam during the day. The company, therefore, turned to electric heating as the most promising field for improving its net revenue. In a town the size of Grinnell very little heavy cooking is done for the evening meal. Consequently, practically all of the heating and cooking load will come during station light

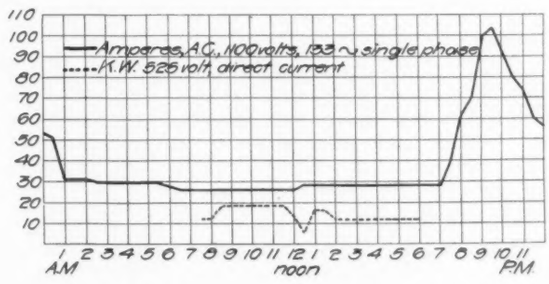


FIG. 3.—GRINNELL LOAD CURVE, JUNE 11, 1906.

load periods. The company has been strengthening its distribution system by installing large transformers and heavy secondaries preparatory to taking extensive heating business. The business done so far is, of course, only the beginning, but it is paving the way for a good load of this kind in the not distant future.

EXPERIENCE OF VARIOUS CUSTOMERS WITH ELECTRIC COOKING.

As information is being sought by central station men as to the cost of electric cooking in different sizes of families under different conditions, the results of the experiences of a number of heating customers at Grinnell may be of interest.

In one family of five, where all the cooking was done electrically, the bills at five cents per kw-hour for three months of 1907 were as follows:

January	$3.74
February	3.47
March	5.42

Another family of two has no other cooking arrangements than the electric. The gentleman being a traveling man, is absent part of the time, and both members of the family are away at other times. The results are interesting, however, as showing the expenses under such conditions, where light housekeeping is done and where electric cooking is especially applicable.

1906.

January and February	$6.36
March and April	5.94
May and June	8.70
July	2.37
August (no cooking)	
September	2.19
October	4.05
November	2.61
December (no cooking)	

1907.

January	$1.62
February (no cooking)	
March	2.88

In a family of six, where all of the cooking was done electrically for six weeks previous to this investigation, the bill was $6.93.

In a family of seven, part of the cooking was done electrically, most of the baking being done on a coal range, and the coal range also being used in winter to help heat the house. The results in this case are also of interest, and are as follows:

1906.

May	$4.26
June	2.38
July (family absent)	
August	3.55
September	3.48
October	3.67
November	1.49
December	1.54

1907.

January	$4.18
February	1.14
March	1.14

Mr. Paul P. Myers, electrician of the company, kept complete records of the cooking at his home during the month of March. There were ordinarily two in the family, with occasional visitors. The kw-hour consumption for 31 days was 115.4, which, at the five-cent rate, would amount to $5.77. This, however, included considerable experimenting, which Mr. Myers has done with new apparatus, which will be spoken of later. The other figures obtainable from this month's record, are as follows:

Total number of meals, 92.
Number of meals for which cooking was done, 81.
Number of dishes cooked, 209.
Number of times oven was used, 23.
Number of person-meals, 184.
Kw-hours per meal per person, .5.

That the number of kw-hours per meal per person are considerably higher than the usually accepted figure of .33, is, of course, mainly due to the fact that the family was so small, and it requires nearly as much electrical energy to cook for two persons as for three or four. The current used in experimental work also increased this figure. The list of utensils used was: One G. E. percolator, 1 G. E. griddle, 1 Simplex waffle iron, 1 American edgewise broiler, 1 G. E. oven, 2 2-qt. G. E. cereal cookers, 1 G. E. frying pan, 1 American 1300-watt immersion coil for the slow cooker.

The slow cooker is worthy of further notice, as it makes possible some economies which will aid the introduction of electric cooking. It will be recognized by every one familiar with electric cooking, that the success of this method of cooking must depend largely upon the efficiency, or, in other words, upon getting the maximum results possible from a given amount of energy. All are probably familiar with the device known as a hay stove, which is used extensively for slow cook-

ing of meats, vegetables and cereals, and is a rough-and-ready form of the Swedish stove, which Edward Atkinson, the economist, has strongly advocated and improved upon. The hay stove consists simply of a tight box containing hay, in which the cooking utensil is set after the cooking has been started on a stove and is well under way. Its principle is simply to store enough of the heat contained in the water to keep the article cooking for some hours after it is taken off the stove. Hay is a good insulator of heat because it provides so much dead air space around the cooking vessel. What Mr. Myers has done is to adapt the hay stove principle to electric cooking. A 6-qt. tank of water is set in a tight box with plenty of heat-insulating material between the tank and the walls of the box. A tight-fitting heat-insulating cover is also provided. In the tank is placed a 1300-watt American immersion heating coil, the end of the coil resting in grooves in the top of the box and tank so that the coil can be left in the tank and the lid shut down tightly. The plan is to start the water boiling in this tank by turning on the electricity in the immersion coil for a few minutes. The vessel containing the thing to be cooked is then set in the boiling water and the lid is shut down. There are thus four or five quarts of boiling water, the heat of which is being sufficiently stored to do the slow cooking. For example, oatmeal is started cooking in the evening, and when allowed to stand over night in the slow cooker after a preliminary boiling is found hot and well-cooked, ready to serve in the morning without further heating. The temperature of the water in the heat storage tank after standing over night is from 110 to 140.

Another line of experiment Mr. Myers is carrying out is to determine the value of extra heavy heat insulation for the electric oven. Some ovens have been constructed with walls 3 to 4 ins. thick, and it has been found that these ovens can be kept at a baking temperature with much less electricity than is required for regular electric ovens with thin walls. While the heat radiation from the ordinary electric oven does not seem to amount to much, yet the fact that the temperature of such an oven does not rise very much after reaching a certain point indicates that there is considerable radiation. Evidently one of the problems to be solved in connection with electric ovens having better heat insulation than is common, is that of preventing them from getting overheated in case the electricity is left on unintentionally for a long time. In the ordinary electric oven this is to a large extent taken care of by radiation, while in the ovens with thick walls this might not be the case. However, since the electric oven is by far the largest energy-consumer of the entire array of electric-heating appliances, and since it is of most vital importance to reduce its consumption, this line of experiments with better heat insulation of ovens is considered as having a very important bearing on the growth of the business.

The company recently offered to donate to the Ladies' Congregational Society the necessary electric cooking outfit for serving suppers given by that organization at regular intervals during each winter season. This offer has been accepted, and the company will put in two five-gallon coffee urns, one ten-gallon water-heater and one large oven. Heretofore this cooking has been done on a number of gasoline stoves, and the ladies will welcome the exit of these stoves from the church kitchen.

HOUSEHOLD MOTORS.

Although the household electric motor can hardly be called a heating appliance, its bearing on central-station load is very similar to that of heating appliances, and it is, therefore, considered in this article. Some time ago the company had an opportunity to pick up a job-lot of nameless single-phase 133-cycle, ½-hp motors at an absurdly low price. Twenty-four of these were purchased, and all were soon placed among residence customers in Grinnell. They are belted to a short line shaft, and this line shaft is used for running washing machines, wringers, ice cream freezers, etc. Mr. Cole, the manager, tells an exceedingly good story on himself in this connection. It seems that for some reason his own house had not been equipped with one of these motors at the time they were distributed. His wife recently was bargaining for a woman to do the weekly washing. The bargain had almost been closed when the candidate for the position said, "Of course, you have a motor to drive your washing machine?" "No, we haven't," was the reply. "Oh, well, I can get plenty of places to wash where they have motors; I don't believe I want to do your washing," was the candidate's answer. Mr. Cole is now aware of the fact that the more washing machine motors he gets in the town the harder it will be for those not provided to resist when forcible arguments of this kind are brought out by the washerwomen.

OFFICES AND DISPLAY-ROOM.

The accompanying photograph, Fig. 4, gives a very inadequate idea of the very neat little office which the company recently opened on one of the principal business streets. The

FIG. 4.—OFFICES AND COOKING DISPLAY AT GRINNELL, IA.

office had before been in unattractive quarters at the plant, in an out-of-the-way place. Electric heating appliances are the most prominent things in the window display. Across the back of the window are the words, "Light, Heat and Cook with Electricity." All of the heating appliances shown in the window bear placards explaining what they are, as seen in the photograph. Some complete electric ranges are kept in stock for display. One of these is shown at the right.

Establishing Day Circuits in Towns of 10,000 Population and Under.

One of the papers on the "New Business Day" program of the National Electric Light Association at Washington, June 7, which attracted the most attention and provoked the most discussion was that of Mr. F. H. Plaice, of New Bremen, Ohio. This paper, although by the manager of a very small and heretofore obscure central station, probably gave the commercial department men at the convention as much to think about as any paper presented, because it showed what can be done under what would appear to be most adverse circumstances. Following is an abstract of this paper and discussion:

In opening Mr. Plaice said that the possibilities of the smaller locality have been overlooked or neglected until to-day the average central station management is honest in the belief that a day service in the little town is impossible. While it may be admitted that the average electric company operating in small localities has a precarious existence, still there are examples to prove the contention that the companies are themselves entirely to blame for such a condition, and that the communities at large can in no way be held as being responsible. It is this subject of seeking for profitable new business by a small company which has undertaken the task of maintaining a 24-hour service in a town of less than 1500, to which the paper relates.

First, electricity is generated by gas engines using natural gas. Coal costs $3.40 delivered, while natural gas for all purposes is supplied at 25 cents per 1000 cu. ft.

There are no public contracts, the company being dependent upon commercial work alone. The earnings at time of beginning day service, May 1, 1904, were somewhat less than $4 per capita per year. With these conditions it was determined for various reasons that a 24-hour service should be attempted, and with that in view, future plans were laid.

A sliding scale of rates on a basis of the number of hours of service was decided upon with some variations.

This rate is, for the 7½ hours' use of the maximum demand, 20 cents; next 7½ hours, 10 cents; next 15 hours, 9 cents; next 20 hours, 6 cents; next 30 hours, 3 cents; all after that, 2 cents, or 7 cents for a 3-hour service and 2 cents thereafter. There is no minimum, no meter rental. Renewals are free.

The hours of service were determined neither by the actual maximum demand nor by the maximum rated load installed but by a figure based more particularly on the area to be lighted and approximating ¾ watt per square foot of floor area. A customer was allowed to install as many and as large units as might be desired. The one using the large energy per square foot pays a much lower rate for his energy than the economical customer who preferred smaller illumination. The object was to encourage or force liberal use of electricity and the rapidly falling rate was to enable long hours of service.

This system has been very satisfactory. The average output per month has been 20,000 kw-hours for a 250-kw plant. The average return to company is 5 cents per kw-hour gross and 1¾ cents per kw-hour net.

Free wiring has been done for some years and it was decided to extend this principle to all applications that a possible customer might desire to use; but, it was decided to make such installations on a rental basis and a charge of 1 cent per month for $1 invested was decided upon. This method has been highly successful with the company, and under it are included all classes of equipment, such as motors, shafting, pulleys, belts, wiring, lighting fixtures (except arc lamps for which no rental is charged), heating utensils of all kinds; in fact, everything that will assist in the increased sale of electricity. The only contract that is required on such installations is one showing the itemized ownership of the same by the company and the rights of removal at the company's option. The extent to which this plan has been followed is shown by the fact that of the 370 service taps connected to the lines, nearly three-quarters feed installations belonging to the company.

The service is as near high grade as most cities maintain and this is best proven by the fact that during a two-year bitter franchise fight between the company and the town, not one word has ever been said against it.

Very little money has been spent in the usual forms of advertising, and while there is no doubt as to the great value of printed advertising in large places where the public must be reached indirectly, the fact that in small localities the person doing the soliciting is or should be personally acquainted with every person in the territory, renders this form of advertising unnecessary. Personal work may take many forms. For instance, the electric company can, with profit to itself, become the consulting engineer for all mechanical enterprises in its field even though at the time there may be no opportunity to add any additional service thereby. Again, if an illuminating engineer is almost a necessity in a large city, how much more important is some knowledge of that art in a little town where customers have no conception whatever of colors and light, and but one idea, that of getting lots of light for little money.

Installing service on trial is another form of effective advertising. Trading in equipment that electric service renders unnecessary is another, and an excellent form, for it eliminates equipment from future possible competition. Along this line it has been the practice of the company to dismantle gas or gasoline lighting outfits as soon as electricity is installed and in this way do away with a future unpleasant possibility.

The policy of the company has been to take special pains to secure the little customer, both lamp and motor, and it has never refused to place its service into premises on any service of 16 candle-power or over. One result of this has been that the Standard Oil Company has sent one of its special agents into the town to see why the oil sales were running so low.

Flat irons are especially profitable as day load and with something over 60 irons in service the company can claim a new kind of peak load. This strikes the station about 10 o'clock on Tuesday morning, and on a hot summer morning has been known to reach over 150 amperes above normal and last, with a drop at noon, until 4 or 5 o'clock. On more than one occasion, this load, through coming on with the motor peak, has necessitated starting a second engine. Although using very little energy singly still collectively, sewing machines and washing machine motors are good household energy salesmen.

The company has been making experiments as to rural service with a view of extensive work in that line, having 6 miles of such lines in operation supplying a 24-hour service under same conditions and rates as apply within the town. Fifteen motors, aggregating 50 horse-power and about 150 lamps are connected with these lines and the results are very encouraging. In all, the company has at present connected to its lines, 7000 incandescent lamps of all sizes, 45 enclosed arc lamps and 90 horse-power of motors, earning on a capitalization of $15,000, no bonds, an average income of $1,000 per month in a town of less than 1500.

In conclusion, the experience of this company indicates that some form of demand system of rates is desirable; that great energy be used in securing many little customers; that some form or method of free installation of equipment is desirable; that a personal rather than an impersonal form of advertising be used but that the advertising allowance be of liberal proportions to the income; that co-operation in everything electrical is to be desired and that the little company should by all means join the electrical associations, both State and National.

In the discussion of this paper, in answer to a question, Mr. Plaice said that the largest customer the company consists of six concerns located in an arcade, with which a contract amounting to a minimum of $900 per year was made. This concern rarely took more than the minimum called for. The next largest customer paid about $150 per year. About 85 per cent of all the buildings in the town were wired. The rural service spoken of was taken care of with 550-volt, direct-current service. This rural service covered an area about five miles in diameter. Bare wire was used outside of town. For lighting from this service two 250-volt lamps were connected in series. Only seven lamps were connected on each branch circuit, each circuit being fused with a cut-out placed outside of the building. Every customer's service was provided with kicking coils and a lightning arrester. Some time ago, before these precautions were taken, there was considerable trouble from lightning, but no trouble since then. On one dairy farm near town there has recently been installed a milking machine operated by a motor. This milks four cows at a time. The operation of the motor costs $6 per month. Formerly three men were hired to do the same work that is now done by the machine.

He described one rather unusual practice, the object of which is to give customers plenty of light for their money and prevent the use of inferior lamps, as well as to make customary the use of lamps of over 16 candle-power. The company purchases 16-cp incandescent lamps taking four watts per candle on 110 volts. The company's service, however, is 120 volts, so that the lamps operate actually at 22 candle-power. A similar practice prevails with lamps of lower candle-power. The result is that customers have practically a lamp of about 3.1 watts per candle. This gives high efficiency and at the same time causes more liberal use of electricity than if a 3.1 watt, 16-cp lamp were purchased. The company furnishes free lamp renewals. The scheme of rates is such as to encourage the liberal user. In answer to a question as to what had become of natural gas competition, Mr. Plaice said that there was no gas lighting left in the town. There were, however, several gas engines in the town.

Electric Heating Applications.

In a paper presented at the Washington convention of the National Electric Light Association entitled "Electric Heating Without Special Concessions from the Central Station," Mr. C. D. Wood gave an account of the experience of the New York Edison Company in introducing electric heating without making special concessions in rates.

In introducing the electric iron cards are distributed, telling about the steps saved by the electric iron, to the employment agencies, and left at the kitchen entrance; circular letters, with return postal cards, are then mailed to the lady of the house. No matter how ignorant and superstitious the laundress may be, after she has once used an electric iron she will refuse to return to the old one—in one case, the domestic threatened to leave if the electric iron were not purchased after it had been used on a ten-days' trial. An average family of five persons, where the collars and cuffs are sent out to be ironed, consumes about 13.2 kw-hours of energy per month, which represents, at a 10-cent lighting rate, an income to your station of $15.84 per year. The automatic handle attachment, which cuts off the electricity when the iron is not in use, has proved a failure, as the operator invariably ties down the handle. A satisfactory automatic cut-off has yet to be developed.

For summer use, there have been installed in several high-grade dwelling houses electric clothes-dryers, the heating units varying in capacity from five to ten kilowatts, depending on the size of the dryer. A cabinet eight feet high, eight feet wide and eight feet deep, may be built in sections, each section equipped with a unit of two kilowatts; this division makes possible a saving of energy when a small amount of work is to be done. During the months of July and August, 1906, a dryer of this capacity consumed about 100 kw-hours per month, which was billed to the customer at a 10-cent rate. The dryer was satisfactory in every respect.

Plate warmers of 800-watt capacity are included in the specifications of the architects in many houses. The New York Edison Company has connected as many as 25 plate warmers in as many different houses in one month. The average consumption of these devices is 24 kw-hours per month.

Of the small home devices, the water cup has been the most pleasing, with the possible exception of the heating pad. The medical fraternity has been approached with electric sterilizers, and was found waiting for just such a device. No doctor likes to use gas; his sterilizing consumes about 800 watts, and the average office use of this device is in the neighborhood of 20 kw-hours monthly.

The bookbinding industry affords an excellent opportunity for electric heat. It is possible to supplant the gas-heated embossing press with electric heating units, and make a very fair comparison with gas, when electricity is sold for five cents per kw-hour. Steam is generally purchased by the month—a 24-hour expense, regardless of when the heat is needed. On the other hand, gas is not clean, nor is the desired heat steady enough for high-grade work. The New York Edison Company has several good installations of this class of apparatus; one having been operating steadily for two years. There are three embossing presses in this equipment. The head of the largest is 19 ins. x 12 ins.; the machine has a small panel-board placed within easy reach of the operator, on which are placed two double-throw switches. There are four resistance units in the press head, placed at equal distance from the center, and by means of a change of connection from series to parallel eight different degrees of heat are obtained. The large press is rated at 220 volts and 16 amperes. The resistance units may be placed in the holes left vacant by the extraction of the old steam pipes. Some manufacturers supply a hot steel plate, which may be placed next to the die; these plates take about five amperes and are connected to the lighting circuit. The machine, 19 ins. x 12 ins., referred to above, reached a temperature of 354 deg. F. with an expenditure of 4.07 kw-hours, starting with a room temperature of 75 deg. The "running" power or low heat was 0.6 kilowatt, which kept the head at the proper temperature while making 480 impressions of the die per hour. The monthly cost of energy for the past year for this work at a seven-cent rate was $8.05 per machine. The Association of Bookbinders is demanding these electric heads.

Twenty-five inversion coil glue-pots, two-quart capacity, were installed in a bookbinding house Feb. 1, 1906, and thus far only one has been replaced. The energy consumption has been 812.5 kw-hours monthly, or an average of 1.3 kw-hours per pot per working day. Figuring the energy at five cents per kw-hour, a wholesale price, the cost per month was less than when the company used gas and the work was identically the same. The operators will regard a heat-regulating switch when they will not turn down the gas.

The New York Edison Company is supplying electricity for the purpose of welding iron bands used in the trunk industry. The welding machine receives alternating current at 110 volts and, by means of a transfer mounted on a frame of the machine, reduces the e. m. f. to 22 volts. The cross-section of the work is a quarter-square inch. The current consumption of the welding machine under pressure runs from 25 to 35 amperes. The energy consumption of the machine while making 480 welds per hour is about 1.16 kw-hours, costing 0.02 cent per weld at a 10-cent rate. In this particular case, a motor-generator set was used to generate the alternating current, which materially lessened the efficiency of the whole plant. This work should be particularly interesting to managers of alternating-current systems.

Electricity was used in the recent construction of the Hoffman House in New York City, for cutting steel piling. Alternating current at 50 volts pressure was utilized by connecting one cable to the steel piling itself and the other to a carbon electrode that was fastened by a copper plate to a wooden guiding pole. Six hundred and fifty amperes were developed at the arc, which represents 32.5 kilowatts. In an eight-hour day, 10 feet of piling could be cut, at an expenditure of 260 kw-hours. At 10 cents per kw-hour, the work cost $26 plus the wages of the attendant, which made the total cost exactly $3.00 per foot of piling. It required two men at $4.50 per day, and two electric drills consuming 44 kw-hours, to drill one foot of piling per day, costing $13.40 per foot. The heating method shows a saving, regardless of time, of $10.40 per foot.

The milk supply of New York City is governed by tests made in the city laboratory by means of electric stoves. Twenty-five 3.5-inch disk stoves, of 60-watt capacity, are used to boil the ether used in the test. Fourteen times per hour these little stoves cause the ether to vaporize and rise from the containing flask to a condensing chamber that holds the milk to be tested. The ether after condensation is released by a siphon and conducted into the original flask. An open gas flame could not be used for this work. The medical officer in charge was so well pleased with the operation of these stoves that he wished to heat and regulate his incubator, or germ cabinet, with electricity. The germ producer is 22 ins. x 22 ins. x 22 ins., and the temperatures to be maintained are 100, 110, 120 and 130 deg. C. The cabinet is made of sheet copper with three jacketed walls, having a maximum current consumption of 16 amperes. The heavier current is used only 15 minutes of the hour, as three amperes are sufficient to keep up the desired temperature. A thermostat with four contact points furnishes the automatic heat regulation. The regulation has been perfectly satisfactory.

The cocoa and coffee trade has applied electric heat to its small desiccating or drying cabinets. A dryer 3½ ft. x 2 ft. x 5 ft., requiring a temperature of 150 deg., will need about 74 watts per cubic foot when properly jacketed. One heater of this kind has returned a revenue of $11 per month. The cocoa and coffee beans are particularly susceptible to the odors arising from combustion, hence the advantage of electric heat. For drying kilns about 40 watts per cubic foot are advised.

Warming tables and chocolate dipping pots have proved successful in the candy trade. Fifty watts, or the power of a 16-cp carbon-filament lamp, produces enough heat to keep the chocolate in working condition. Wherever these chocolate heaters have been installed they are at work to-day. The energy

consumed in the device itself is not large, but it will surely lead to more business along this line. An estimate has been given a manufacturing concern to heat a 30-gal. batch of caramel paste to a temperature of 285 deg. F. The operation will consume 10 kw-hours of energy, and each melting will cost about 65 cents. The service is intermittent, hence the adaptability of electric heat. Where high-grade candy is made there is always a chance for electric heat.

The manufacturers of switchboards and telephone supplies find a useful, economical tool in the electric soldering iron. A soldering iron equal to a 1.5-pound soldering copper will consume 70 watts. The operator will accomplish more work with this tool, thereby saving time. Heaters of 110-watt capacity are now made, into which a soldering iron may be thrust, thereby doing away with the connecting handle cord. One thousands hogs per hour are stamped "Inspected" by the government meat inspectors in Chicago, by means of a 400-watt branding tool that is nothing more than an electric soldering iron with a die inserted in place of the copper tip.

Electric heat economies are not fully appreciated. A certain manufacturer in New York City has been paying $30 per month for a steam supply that is used in a secret wood-working process. He was persuaded to try electric heat and found that he could do the same amount of work as before with a monthly consumption of 50 kw-hours. He was buying energy at 10 cents per kw-hour, and his yearly saving was $300.

Following are details of the operation of a 44-cell storage battery outfit, mounted on an automobile truck, and used for thawing out frozen water pipes in winter, in comparison with those obtained by the use of a rheostat in series with a direct-current, three-wire system with the neutral wire grounded. The figures represent the average amounts in each case.

	Amp.	Kw-hours.	Time, Min.	Pipe, In.	Voltage.	Cost per Case.	Revenue per Case.
Storage battery...	513	1.39	5.44	5/8	31.5	$10.85	$16.40
Three-wire	275	10.4	19.0	5/8	120.0	14.43	16.93

The three-wire system is used until the season has so far advanced that the number of cases will warrant the exclusive service of an automobile truck.

Although little has been done in New York City in the introduction of electricity for complete commercial ranges, there are six or eight kitchens in operation, where one meal per day is prepared for the officers and clerks of the various business houses to which the kitchens are attached. The average capacity of these outfits is 10 kilowatts. There are a few restaurant broiler sets used for broiling meats during the noon luncheon hour. These broilers, which are not to be considered complete kitchens, bring a revenue of $12.50 per month, at an average rate of 8 cents per kw-hour. The Waldorf-Astoria Hotel contains the largest cooking unit in the United States, comprising 19 upright broilers, four warming ovens and four regular ovens, with a total capacity of 460 amperes.

One manufacturing company in central New York is preparing food daily, all cooked by electricity, for 2000 employees.

The greatest difficulty in residential work has been the absence of adequate carrying capacity in risers, special circuits and available extra circuits. The customer will often be willing to pay the first cost of the device; he will accept the consumption figures, but he will flatly refuse to stand the expense of special wiring. To overcome this difficulty an agent has been appointed whose business it is to interview architects and contractors for the sole purpose of advising with them regarding the extended use of electricity for heating work; in other words, making it possible for the future owner to use the various heating devices that he desires. There are several residences in the city of New York to-day that are wired with separate heating and power circuits. A heating and power circuit, 220 volts, in a four-story city residence having basement and sub-basement will cost about $850, exclusive of the devices. This figure is based upon a new house with the heating circuit independent from the lighting circuit. The irons might be placed on the 110-volt lighting circuit, which would reduce the cost.

Persons Entitled to Patents.

BY JOHN EDSON BRADY.

A patent may be lawfully granted only to an original inventor and letters patent issued to any other are invalid. The patentee must not only have an honest belief that he is the originator of the device, the production of which he seeks to control under the patent laws, but he must in reality be the first and original inventor. If the knowledge, necessary to perfect a patentable device, was obtained by the patentee from another, then the patentee is, of course, not the original inventor, and a patent issued under such circumstances is void. The same is true if some one other than the patentee has anticipated the device, even without the knowledge of the person claiming to be its inventor, by a prior use of the patented article in the United States or by a published description of it at home or abroad. Subject to these and other limitations laid down by the patent act, which have been previously discussed in these columns, any person may become a patentee. Foreigners are accorded the same rights under the patent act as are citizens and married women stand upon the same footing as all others. The one exception operates against the officers and employees of the patent office and is to the effect that they shall be incapable, during the period for which they hold their appointments, to acquire, except by inheritance or bequest, any right or interest in any patent issued by the office. This provision, however, does not disqualify a commissioner of patents from obtaining a patent after his term of office has expired for an invention made by him while holding such office and, in such case, the invention will date back to the time when it was actually made, although he could not have obtained a patent for it at that time. Foote vs. Frost, 3 B. & A. Pat. Cases, 607.

The term "original inventor," in patent law, is used to designate a pioneer in the art; one who evolves the original idea and brings it to some useful, successful and tangible result. And, to be entitled to a patent, a person must come within this definition. Norton vs. Jensen, 90 Fed. 415. No one can be an inventor unless he has performed a complete inventive act, that is, conceived an idea of means and reduced it to practice in some art, machine, manufacture, composition of matter, or design. If one is granted a patent upon an idea which did not originate with him, his letters are worthless, even though he had obtained the consent of the original inventor before applying for the patent. The rule is illustrated in the case of Hartshorn vs. Saginaw Barrel Company, 119 U. S. 664, in which it appeared that Hartshorn and Campbell, at about the same time, had invented substantially the same improvement for shade rollers. They employed the same solicitor to protect their rights by obtaining letters patent, and the solicitor erroneously, but in good faith, assigned the priority of invention to Hartshorn, because his claim was received first, when as a matter of fact Campbell was the original and first inventor. A patent was secured for each inventor, but Campbell's claim was limited to an attachment not included in the invention of Hartshorn. The mistake was not discovered until nine or ten years later, when it was brought out in the testimony offered in an action brought for the purpose of restraining an infringement of one of the patents. Upon the discovery of the mistake an attempt was made to correct it by a simple exchange of claims. But in the present action by Hartshorn against the Saginaw Barrel Company it was held that Hartshorn's patent was void. Campbell's acquiescence in Hartshorn's claim to priority was regarded, as far as he was concerned, as an abandonment of any right on his part to a patent for the broad and real invention, and, having deliberately rested in that acquiescence for a period of between nine and ten years, it was too late, according to the settled course of decisions, to resume his rights. It was no answer to this to say that, in the meantime, the invention had not been dedicated to the public by virtue of Campbell's abandonment because it was covered by Hartshorn's patent, as Hartshorn's patent was invalid for the reason that Hartshorn was not the original inventor.

But mere priority of conception, without more, will not confer priority right to a patent. That is, if a person conceives it a patentable device, but either because he does not consider it of sufficient consequence, or for some other reason, neglects to put his invention into a fixed or practical form, his conception will not defeat the rights of another who subsequently makes the same discovery and obtains a patent thereon. In 1870 one Allison conceived the idea of an improvement in rotary drills. At that time he made several pencil sketches of his device, none of which were preserved, but he did not think the invention important enough to warrant its reduction to permanent shape. In 1881 a patent covering the same device was issued to Albert Ball, and in 1882, after the market was being supplied with machines equipped with the device invented by Ball, Allison applied for and obtained a patent. His application was made at the solicitation of a company, which afterwards took an assignment of the patent and brought action against the assignee of the Ball patent to restrain what was claimed to be an infringement. It was held that the rightful priority of invention must be accorded to Ball and that his patent was not invalidated by the fact that Allison had thought out the device and made rough sketches of it before letters were issued to Ball. Here, Allison was the first to conceive of the invention; but mere conception, which is not seasonably followed by some practical step, counts for nothing as against a subsequent and independent inventor, who, having complied with the patent laws, obtains a patent. It would indeed be a strange perversion of the patent laws if one who had conceived of a new device, and proceeded so far as to embody it in crude sketches or even in finished drawings, could there stop, and yet hold that field of invention against all comers for a period of twelve years. The law does not so reward supineness. Hence in Reeves vs. Keystone Bridge Company, 5 Fish. 456, Judge McKennan declared the established rule to be "that illustrative drawings of conceived ideas do not constitute invention, and that, unless they are followed by a seasonable observance of the requirements of the patent laws, they can have no effect upon a subsequently granted patent to another."

In the case of Standard Cartridge Company vs. Peters Cartridge Company, 77 Fed. Rep. 630, the question arose in a somewhat different form. An inventor, named Hisey, applied for a patent upon a cartridge loading machine in which an endless chain was substituted for the circular table of the older machines as a means of conveying the empty shells to the loading apparatus. Before the patent office had acted upon the matter, Ligowski, another inventor, filed an application for a patent of the same device. In an action to determine which of the two was vested with priority, Hisey testified that the invention was original with him, having been suggested to him by "observing a bicycle go by that had an endless chain to transmit the power." Ligowski testified that, prior to the time when Hisey claimed to have hit upon the idea, he (Ligowski) had made sketches of the machine which he showed and explained to Hisey. Hisey flatly denied this so far as it concerned him and the question became one of veracity which was determined in favor of Ligowski. It was assumed from the evidence that Ligowski had disclosed to Hisey all that he had done or conceived concerning a cartridge loading machine, embodying an endless belt carrier, before the time when Hisey claimed to have made the invention. If Ligowski's conception, at the time of its being communicated to Hisey, was sufficiently developed and perfected to enable one familiar with the construction and operation of the old type of machine to construct a machine equipped with the novel improvement in question by the mere exercise of mechanical skill and without further invention, he, and he alone, would be the first inventor and Hisely would be in the position of appropriating the conception of Ligowski. On the other hand, if Ligowski had only an inchoate idea that in some way an endless belt carrier, suitably actuated, might be devised, which could be substituted for the old rigid circular carrier, but did nothing towards developing or demonstrating the utility of his conception, he would not be an inventor at all and Hisey's rights would not be impaired by reason of any such indefinite suggestions made to him. The mere existence of an intellectual notion that a certain thing could be done, and, if done, might be of practical utility, does not furnish a basis for a patent, or estop others from developing substantially the same idea. It was held that Hisey had gained all the knowledge necessary to enable him as a good mechanic to construct the machine from Ligowski, that the fact that Ligowski had failed to promptly file his application for a patent could not, under such circumstances avail Hisey, and that Ligowski was entitled to the patent. The rule, as it appears in the American and English Encyc. of Law, Vol. XXII, p. 347, is as follows: "Of two or more rival inventors the one first conceiving the idea of the invention is entitled to the patent, provided he uses due and reasonable diligence in perfecting it and adapting it to use, and in fact does so, although a subsequent original inventor may be the first to reduce it to actual use." Between two inventors, one just as early in his conception as the other and equally meritorious otherwise, the one who first gets the patent is to be favored.

The first inventor does not forfeit his priority by taking a reasonable time to experiment and test his invention, but he loses his right to priority by an unreasonable delay in perfecting and adapting his invention or applying for a patent, if in the meantime some one else gets in ahead of him. An improvement in grain binders was conceived by John Appleby in June, 1879, and at that time was orally explained by the inventor to several persons skilled in the construction and operation of harvesting machinery in a manner so clear that any good mechanic could have made the device from the descriptions given.

Later, in the summer of 1879, Charles Jewell worked out the same device and had it attached to one of his machines. He applied for a patent in April, 1880, and in June, 1881, Appleby filed his application for a patent. It was held that Appleby had not waived his right of priority by delay. He was entitled to a reasonable time, to be judged of according to the circumstances of the case, in which to perfect his invention and reduce it to practice, without impairing his claim to priority. His invention was an important one, and he had a machine with it on in the field before the harvest of the year following its conception. He might have been more expeditious in having a machine made embodying his invention, but the court was of the opinion that he had not delayed for an unreasonable period and that he was entitled to the patent, notwithstanding that Jewell got his application into the patent office first. McCormick Harvesting Machine Company vs. Minneapolis Harvester Works, 42 Fed. Rep. 152.

A case in which the inventor lost out as a result of his indifference in the matter of securing a patent is that of Wright vs. Postel, 44 Fed. Rep. 352. The plaintiff was in court for the purpose of enjoining an infringement of a patent which he had secured on a gilding machine. The proof showed that, in the winter of 1883-1884, he had described the device in general terms to his solicitor, and that in 1886 he repeated the description more fully, but it seems that he did not intend at either date to reduce the invention to practice. His only concern was to protect himself in the construction and sale of the machine as made under an earlier patent. His monopoly in this served his interests as well as the taking out of a new patent would, provided competition could be avoided. Being advised that the earlier patent covered his new invention, which was in the nature of an improvement, and would keep all others off, the plaintiff rested content until February, 1887, when he became alarmed at something observed or heard of the defendant's movements and resolved to apply for a patent. The patent was issued but it appears that some months prior to the application therefor the defendant had devised and constructed the machine which the plaintiff complained of as an infringement. It was held that the plaintiff had not exercised sufficient diligence in reducing his invention to practice and that a reduction of the same machine to practice by another prior to the filing of the plaintiff's application rendered the plaintiff's patent invalid. In Christie vs. Seybold, 55 Fed. Rep. 69, it appeared

that the person who first conceived a comparatively simple improvement in power presses for book binding made a rough sketch of it within a few months thereafter. Three years later he had working drawings made and six months after that a machine was manufactured. He excused the delay by saying that he could neither afford to buy the necessary tools sooner nor use them in his small shop. His reason for not having the machine made at another shop was that he would have realized no profits on machines made by others according to his invention. It was held that he had not so conducted himself as to be entitled to a patent against one who had conceived the invention later but who had reduced it to practical use without delay.

The cases which have been referred to will serve to bring out the proposition that one who desires a patent must be vigilant in reducing his invention to practical form, and in applying for letters. The patent laws are intended for the benefit of the public as well as of patentees. They are designed to stimulate invention for the common advantage. It is, therefore, the duty of inventors to use reasonable diligence in putting their inventive ideas into actual practice and in securing their rights under the patent act, and they cannot neglect this obligation without danger to their own interests.

Pull Boxes in Conduit Work.

BY T. W. POPPE.

A most convenient article used in connection with conduit work is the "pull box," so called because the conductors are pulled into the conduit to the pull box and pulled from the pull box to the place where they are connected to the apparatus.

It is convenient because with it one can overcome the possibility of having too many bends in one continuous line of conduit, thus avoiding trouble later when drawing in the conductors. Also in places where the conduit would necessarily have to be placed in such manner as to cause much trouble in bending it to fit and also in drawing in the conductors.

To illustrate: suppose five lines of 2-in. conduit are run on a side wall and it is desired to carry them across the ceiling at right angles with the wall. In Fig. 1 the lines of conduit are shown on the wall and the bend which it would be necessary for them to make in order to run close together and parallel when carried across the ceiling.

Some of these bends it would be impossible to make. If it were possible to bend the conduit as shown it would be a difficult matter to draw in the conduits. Fig. 2 shows a pull box placed on the wall; the top being close to the ceiling. On the front of the box and close to the ceiling is fastened a board *B*. This should be wide enough to enable the proper sized holes to be bored for the conduit. After the conduit enters the pull box at the side it leaves it from the board *B*. The conductors when drawn into the conduit as far as the pull box in one direction are pulled away from the box into the corresponding conduits. This is an easy means of overcoming a disagreeable and difficult task.

It might be necessary at times to run conduit through two partitions, one at right angles to the other. Fig. 3 shows the partitions and the way it would be necessary to run the conduit. This would necessitate the cutting of running threads on each line of conduit, a laborious and unsatisfactory method, as a running thread on a horizontal line of conduit is never as firm a job as when the conduit is run vertically. The weight of the conduit in the latter case will aid in keeping the running thread firm, but when run horizonally the weight of the conduit itself will cause it to sag at the running thread. A pull box can be placed in the corner, fastening it to the ceiling and the conduit brought into it and out of it, as shown in Fig. 4.

A pull box should be placed on lines over 100 ft. in length or having four or more bends equal to four elbows. The bends and the distance necessitate a means for taking the strain from the conductors when drawing them into the conduit; and there is no better way than to draw in a portion of the conductor at a time. A pull box permits this.

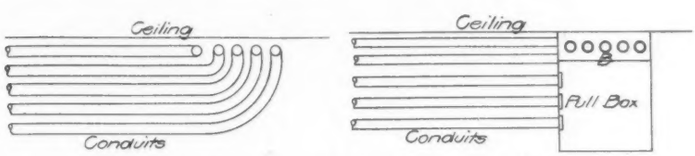
Pull boxes can be designed and constructed to suit any conditions. Where a number of large conduits are to run parallel on the ceiling and all are to be bent at the same point and means of bending them are not at hand, a box can be constructed and made to take the place of the bend as shown in Fig. 5. This saves time and labor and the avoidance of bending large conduit which means a saving also of material.

In Fig. 6 conduit is shown running on the ceiling and also on the side wall. The conduits on the wall are a continuation of the ones on the ceiling. *B* is an L-shaped pull box, the conduit being brought into the box on one side and taken out on the opposite side on the wall. This box is particularly convenient as it avoids the use of three elbows in each line of conduit and saves much labor fitting and cutting the conduit.

A little thought regarding pull boxes when running conduit will save much labor and time, and will often result in overcoming conditions which could not otherwise be successfully met if only conduit was used.

A pull box can be constructed of wood and lined with sheet iron 1/16 of an inch thick or it may be constructed wholly of iron. If made of cast iron it should be made thick enough to be mechanically strong. If the box be made of wood, the holes through which the conduit will enter the box should be bored and a templet made. This is usually done by cutting stiff paper the size of the side of the box and marking on it with a pencil the position of the holes. This templet is used for the purpose of drilling the holes in the sheet iron with which the box is to be lined.

Locknuts should be placed on all conduit entering or leaving the pull box, both inside and out, so as to prevent any displacement of the conduit when drawing in the conductors.



FIGS. 1 AND 2.—IMPOSSIBLE CONDUIT BENDS AND HOW TO OVERCOME THEM.

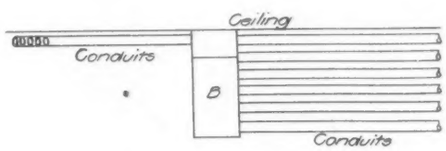
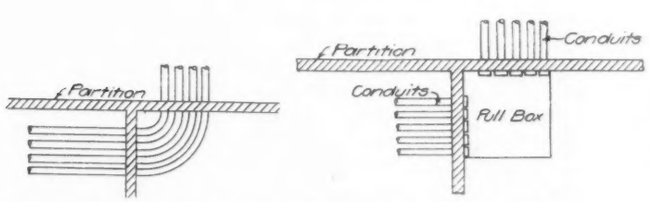


FIG. 6.—APPLICATION OF L-SHAPED PULL BOX.



FIGS. 3 AND 4.—CONDUIT BENDS AND THEIR ELIMINATION BY MEANS OF PULL BOX.

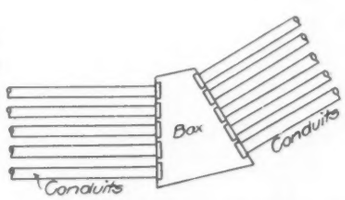


FIG. 5.—MEANS OF ELIMINATING BENDS IN CONDUIT.

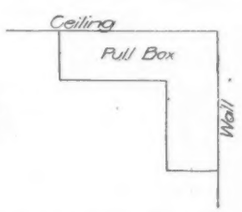


FIG. 7.—L-SHAPED PULL BOX.

Break-Down Service.

By Charles F. Hunter.

The question of so called "break-down service" involves two main considerations: First, if an electric public service corporation can be compelled to install its service in premises supplied with electricity by a private or individual plant, such service to be normally unused and only called into requisition in case of failure of the private plant; and, second, what equitable charge should be made for such service.

As to the duty of an electric corporation to install its service in such cases, the Transportation Corporation law of the State of New York, article VI, section 65, provides that any electric light corporation shall supply electricity to any building or premises within 100 ft. of the lighting mains, upon written application of the owner or occupant of such building, and upon the payment by him of all money due from him to the corporation, and the deposit by him, if required, in advance with the corporation of a sum of money sufficient to pay the expense of installation; provided that the ground in which the leading in wires must be laid is not frozen, nor otherwise presents serious obstacles to the laying of same. This section of the law does not allow an electric corporation to discriminate between customers using electricity for long or short periods of time, in respect to making installations on such premises.

The second consideration, that of equitable charges for "break-down service," is strictly technical in character. The main points to be considered here are, the amount and cost of apparatus to be held in reserve by the corporation to supply the demand of the consumer in the event of a break down of his private plant; and the value of such break down service, considered as insurance against costly interruptions, to the consumer.

The cost of delivering a kw-hour of energy to any consumer depends upon two factors; first, the fixed charges per kilowatt capacity of generating plant upon the investment of the corporation in its plant, salaries, etc.; and, second, the production and distribution charges, which depend directly upon the number of kw-hours produced. The first charges include among others the items of interest on investment, depreciation charges, general expenses, such as office salaries and rentals. These constitute a fixed sum for any given plant or system, which is the same for all conditions of operation, whether the plant is standing idle, but in readiness to run, or operating at full capacity. The second factor is approximately a constant for each unit of energy, and the total charge under this factor is proportional to the total number of units sold. The latter charges comprise the items of fuel and wages in the production and distribution departments, repairs to plant, oil, waste, etc.

A mathematical expression for the above factors would be:

$$K = b + (ac \div n)$$

Where K = total cost per kw-hour

b = cost of production and distribution per kw-hour

a = fixed charges per kw-capacity

c = maximum demand of consumer in kilowatts

n = total number of kw-hours used.

It is evident that as the number of kw-hours used increase, the cost per kw-hour becomes less, and vice versa. The minimum cost per kw-hour will be when the consumer uses his maximum demand continuously for 24 hours of the day. The maximum cost is in the case of a "break-down service" installation, when no need has arisen for use of the service, when the cost per kw-hour would be mathematically speaking, infinite. The total cost, in the latter case, may be represented by the equation:

$$T = n\,b + a\,c \text{ or since } n = o$$

Where T = total cost of service. $T = a\,c$.

The conclusion of the writer is that in a "break-down service" installation, it is unfair to the electric company to set (by law or otherwise) a fixed rate per kw-hour for such service, since the demand for electricity is occasional, and it is impossible to foretell at what time or for how long a period, the operating company will be called upon to furnish such electricity to the consumer; the chief value of such service to the consumer being of the nature of insurance against costly interruptions of service. Rather, a flat rate per connected kilowatt of capacity should be charged, and any use of energy charged for at very low rates. This would take care of the fixed charges on the equipment of the operating company, and at the same time encourage the use of electricity by the consumer.

Lamp Trimmer's Wagon.

The lamp trimmer's wagon in use by the Knoxville Railway & Light Company, shown herewith, has several special features. The wagon was built especially for the service and according to designs furnished by Mr. P. E. Mitchell, general superintendent and electrical engineer of the company. The lamp trimmer who drives the horse occupies a seat in the rear. The lines

LAMP TRIMMER'S WAGON.

extend through the wagon and the brake is placed within convenient reach. The body of the wagon is utilized for drawers and chests containing felt-lined compartments for the globes, and other compartments for carbons, tools, brushes and small repairs. The trimmer's seat folds down against the side of the wagon to permit a drawer to be opened.

Electric Work in Mills.

By Arthur J. Weeks.

There is much room for improvement in the wiring of mills of various kinds, and this work is not receiving the attention it deserves, and the work is not ordinarily up to standard. There is no system, the size of wire is guessed at, especially if alternating-current circuits are needed, and power circuits are so run that it is next to impossible to find which is which in case of necessity. A new man would be compelled to begin at the power house and trace each circuit to its end. Should a fuse blow, throwing out a section of a mill, a long search would be needed to locate the fuse blocks.

It is the policy of some men to cover up their work and keep every one in the dark as to their movements. Often fuses are so placed that they are not accessible except from the top of a long ladder, and no ladder is at hand. Sometimes they are located in lofts or unused storage nooks, as the wires chance to be run through such a place. In steel mills they are hidden away in all sorts of places, seldom accessible, sometimes being found 20 ft. or more from the ground on a block of wood alongside an iron girder. The work is often done by contractors with no one to oversee the details. Poor wire enters into such contracts. In one instance wire which had been

up but a short time was almost entirely bare, the insulation having dropped off in great lengths. Cheap lamp sockets and lamps of undesirable construction are often used. Sometimes two or more sets of fuse boxes are found on one circuit, because a wireman finds a few circular mils difference in size due to an odd size in wire and follows the rule, "Where there is a change in size of wire, a cut-out must be used." So, though the wire is practically the same as the former, another set of fuse blocks is used. This happens in extension work. Some wires and open fuses are located openly in places where the blowing of a fuse might easily cause a disastrous fire. Cross-wires are a frequent source of annoyance, as are wires run too close to belts and hot pipes, or pinned down by later work, or pulled loose to allow the putting up of a countershaft; many such cases could be cited. There should be as complete and efficient a system for the wiring of mills as in the wiring of houses or offices; in many cases iron conduit should be used, in others, molding.

When street-car wiring was done in a slipshod manner there was continual trouble, but since an improved system is used troubles from that source are very rare in well-regulated lines. The writer would recommend for mill work a thorough going over and tracing of every circuit, the eliminating of old unused circuits, recording the size of wire, and keeping a set of blue prints of wiring in each department, with fuses and sizes so located. Mark also location of motor, indicating horsepower. The system thus installed will be well worth while for several reasons: The superintendent can more readily keep tab on the business, and the workmen will give better service and take more interest because of the fact that they do not hold the "secrets" of the place hidden under their hat.

It may not be practical to keep a record of every lamp circuit, but it will be a good thing to state there are so many lamp circuits in such a room, giving the number of lamps in each building. This is important, too, for the superintendent will be surprised to know that certain departments are using more lamps than others, when the reverse should be the case. He will find lamps in use where some machines have been taken out, and will often find two lamps where one is sufficient. Often motors will be found unlighted, and darkness is sure to include neglect.

It is a good plan for the superintendent to make an occasional visit of inspection, to ascertain for himself the condition of the electric apparatus. Give no material to any department except on requisition; this will decrease lamp breakage, waste of tape, etc. What is too easily obtained by the common type of man is not appreciated and is wasted.

In such plants as flour mills, grain elevators, varnish and paint manufactories, etc., extreme care and caution are needed in every detail of wiring and choice of materials. Inspect periodically the entire electric installation and keep it up in shape. This can be done systematically with no extra expense to the system, and the time charged to inspection will be far less than expense charges under the former régime.

Sometimes things are put in such systematic condition that an electrician feels uneasy lest his services should be considered no longer necessary, and many times an injustice is done to the man who is responsible for the smoothness of the run ning. Sometimes, too, the man who recommends and attempts to carry out this rule of system meets with only rebellion and dissatisfaction; yet a little time will usually serve to bring things around in order. When bad work is the rule, and the head of the department, however good himself, has a poor assistant, the business may be so organized that a feeling of "If you don't like it, get out" prevails. A prompt sifting out is here indicated; and the superintendent of a large department should take the time necessary to look after things and see that thereafter the reports coming to him are correct. Such conditions usually right themselves with time, though often several good men are first sacrificed. Certain it is, however, that more system is required in the electrical department of shops and factories, as outlined above, when much waste, risk and extravagance will be promptly checked.

The Regulation of Boiler Feeders—V.

BY CHARLES S. TOWNE.

Having illustrated and explained several thousand dollars worth of machinery and appliances for the regulation of boiler feeders, the writer concludes the series with further consideration of the benefits to be derived from the practical use of these devices.

Fig. 1 is another pump governor in which light mineral oil is pumped from one chamber to another through an adjustable orifice. Fig. 2 shows an application of it to a boiler feeder. So long as the speed for which the regulator is set, is not exceeded, the regulation amount of oil circulates through it, but a slight increase in this speed throws more oil accordingly, and this raises the piston shown in Fig. 1, closes the balanced valve in the steam pipe, or at least reduces its capacity until normal speed is restored.

Fig. 3 illustrates a combined pressure and speed governor that can be readily adjusted to meet various requirements in service. It may be used in a horizontal or in a vertical pipe, according to which is the most convenient for the engineer, and best adapted to the place where it is to be located. Steam enters at 2, comes in contact with the balanced valve shown by which its pressure is reduced to suit the service required, and it then passes out at 3 going to the steam chest of the pump. Pressure from the discharge pipe enters 4 and is conveyed to the cylinder, 5 (which is stationary), where it acts

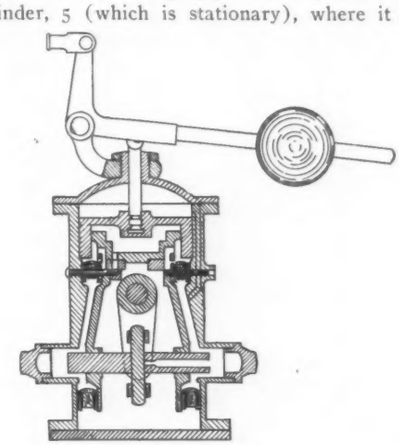


FIG. 1.—PUMP GOVERNOR.

on the piston, 6, and thence through the rod, 7, and the cross-head, 8, motion is imparted to the balanced valve in the steam pipe. This would be quickly closed were it not opposed by the spring, 9, the tension of which may be adjusted at pleasure by the nuts, 10; therefore if more water pressure is wanted in the discharge pipe of the pump, loosen the outer nuts, screw down the inner until the desired increase is secured, then replace the outer as check nuts to prevent the others from becoming loosened by the vibration of the pump. If less pressure is wanted, unscrew the nuts and thus reduce the spring tension.

If the pump runs too fast with a full load, remove the cap, 11, loosen the check nut, 12, and turn the screw, 13, to the right, thus screwing it in, and the speed will be decreased It naturally follows that if greater speed is wanted under full load, the screw, 13, must be turned toward the left, or, in other words, loosened, for this purpose, after which the check nut, 12, should be tightened and the cap, 11, replaced. In Fig. 3 a check nut is shown at 14, an enlarged view of which is presented in Fig. 4. When this nut is loosened the face of the gauge disk, 15, is exposed to view. It is also illustrated in Fig. 5. If it is desired to run the pump faster when the load is off turn 15 towards the letter F, as this indicates "faster." If the speed is to be reduced, turn 15 towards S, which indicates "slower."

A few points on the circulation of water in steam boilers on general principles and without regard to any special type will

be of interest along this line, not as presenting anything that heretofore has not been known to engineers, but rather by way of reviving interest in conditions that are familiar, and whose familiarity breeds the contempt that is unwarranted when all things are considered. When the circulation of water in a well-designed steam boiler is not affected by external conditions, such as the entrance of feed water, etc., it follows a course that is plainly indicated by the rise of heated and the fall of cooled water. Of course, all water in such a boiler is hot, but still all of it is not the same temperature, and furthermore the terms "heated" and "cooled" refer to relative conditions only. The economy of a steam boiler is influenced directly by the rapidity of the circulation in it; therefore the introduction of a disturbing element must always be determined in a greater or less degree. If the feed water for a steam boiler is heated to the boiling point by exhaust steam, under atmospheric pressure, it is still much cooler than the water already in the boiler, which is heated until much of it is practically ready to pass into steam at working pressure, which may be anywhere from 100 to 200 pounds, according to conditions. The introduction of this cooler water interferes with the circulation; therefore in the discussion of this subject, we ask, "Is it better to feed continuously and thus interfere with the circulation at

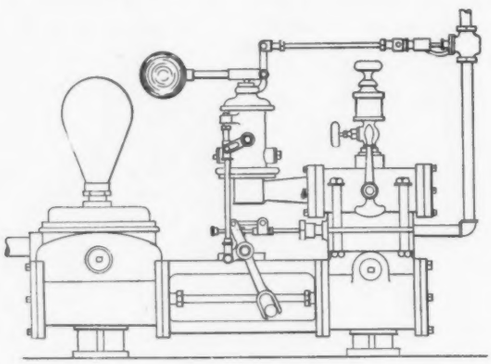


FIG. 2.—GOVERNOR APPLIED TO BOILER FEEDER.

all times alike, or shall we feed, say, one-half of the time that a boiler is in use, and leave it free to do its best work for the remainder?"

If the degree of interference was the same per unit of time, the latter plan would be the best, but this is not the case, because the faster that water enters (in comparison with the rate at which it is evaporated), the greater the interference becomes, not because the water is necessarily much cooler when it is pumped more rapidly through a good heater, as some writers would have one believe, but because the greater bulk of water under its highest attainable temperature from exhaust steam settles to the lowest parts and its tendency is to stay there until thoroughly heated by the fire, which prevents free action.

If all the exhaust steam from an engine is used to good advantage in heating water, it will raise to the boiling point about six times as much as was required to make the steam used, which not only illustrates the action of the latent heat, but proves that exhaust steam can be made to maintain the temperature of feed water under abnormal conditions. If a feed water heater is too small for the duty required of it these results will not be secured; therefore in order to be on the safe side a continuous feed should be maintained, as the circulation is sure to be better.

Although it is laid down as a general principle that steam cannot be superheated while in contact with the water from which it was generated, it is a statement that applies only to steam that is not in rapid motion, as otherwise any surplus of heat tending to accumulate in the steam would pass to the water at once, hence superheating would be prevented. However, there are several kinds of boilers in general use that deliver slightly superheated steam as it flows rapidly through some of the upper parts that are exposed to the direct action of hot gases, and the superheat so obtained is greater in direct proportion to the regularity with which the water level is maintained at a given point.

The principle of expansion by heat and contraction by cold (both relative terms), is very much in evidence in steam engineering, and it greatly affects boilers in every-day service; for if a certain part is covered with water on one side to a given height, and only steam touches it above that point, while

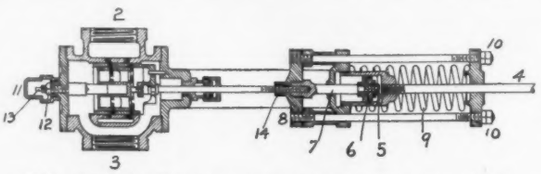
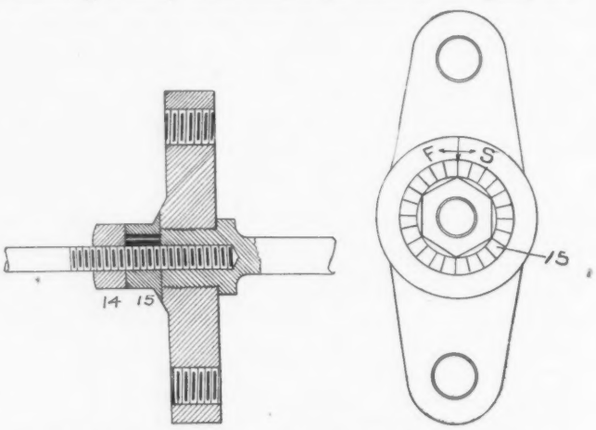


FIG. 3.—COMBINED PRESSURE AND SPEED GOVERNOR.

the whole is exposed to the action of fire on the other side, the strains due to difference of temperature may be severe, even to the point of rupture in special cases, and while superior design modifies these strains, they can never be wholly eliminated.

What effect does change in water level have on steam boilers? Admitting that it does affect the metal, then which is proper, to keep the strain at one point continually by maintaining an absolutely constant water level, or to change the location of it by allowing the water level to rise and fall?

As strains cannot be avoided it is better to maintain them along a given line because the metal will become "set" to meet the prevailing conditions, hence the strain will be greatly reduced, and if the water level is never changed it is possible for it to be entirely eliminated. At the present time the attention of engineers and steam users is being called in a most forcible manner to the fatal defect existing in every boiler that is fitted with a lap jointed seam, whether it is double or single riveted, as many of them are failing with disastrous results. Is it not a significant fact that nearly every such seam is located where it is alternately covered with water and left bare, according to whether there is high or low water under conditions commonly found where boiler feed regulators are not in use, and where a picayune policy forbids the use of high and low water safety water columns? Of course, there are plausible reasons given for failure to install these safety devices, but in practically every case such a dangerous condition of affairs is due to the opposition of an engineer who does not want to have his failures along this line exposed, or to the penuriousness of an owner who had rather spend the amount involved in attending a fancy dress ball, or in some other equally use-



FIGS. 4 AND 5.—SIDE AND FACE VIEWS OF CHECK NUT.

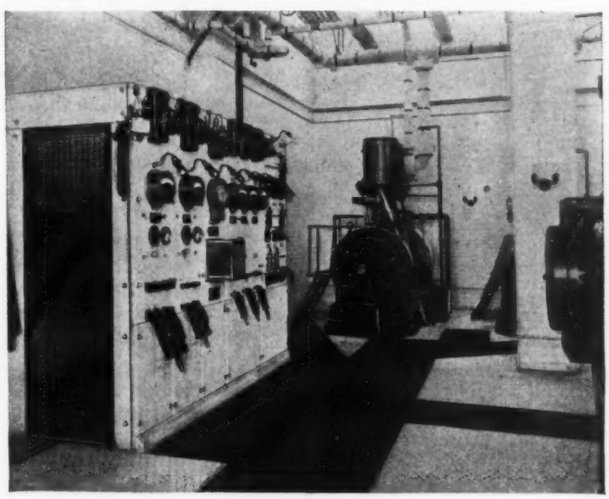
less manner, when compared with the vital interests involved in his steam plant. If the conditions are such that with hand regulation of boiler feeders it is not practicable to prevent frequent alarms on account of too much or too little water, do not muffle the whistles, but install good boiler feed regulators without delay.

LETTERS ON PRACTICAL SUBJECTS.

THE TILED ENGINE ROOM.

Tiling is now quite generally used as a covering for the floors and walls of engine rooms. Its advantages are numerous and should be realized by architects, builders and others, who may be interested in the erection of modern up-to-date power plants of any description.

Tiling properly set in hard cement is durable, fireproof, non-absorbent and easy to keep clean and neat looking. It is made of clay, baked so that it becomes harder than any natural stone or even cement, and being non-porous it cannot absorb moisture, dirt or any other foreign substances which so frequently disintegrate the walls and floors of less substantial



TILED ENGINE ROOM, FILTRATION PLANT, WASHINGTON, D. C.

material. Even a sharp steel blade cannot scratch a vitrified tile any more than the ordinary knife scratches a dinner plate. In flooring materials this fact is of great importance because the most destructive agent of all floors is the hard steel nails of the shoe which soon wear deep indentations into marble, granite, slate and other flooring materials in common use.

With particular reference to the engine room, one of the specific values of tiling the floors and walls is that it cannot absorb the lubricating oil, grease and other similar materials that are necessarily dropped upon the floor, or spattered upon the walls by the revolving crank shafts. Wood, of course, readily absorbs this oil or grease which causes it to emit a more or less disagreeable odor, and, furthermore, renders it highly inflammable. This last condition is all the more dangerous because of the necessary proximity of fire which, in many instances within the past few years, has destroyed many large power plants which would have been standing to-day had the walls and floors been made of an inorganic material.

The modern machinery of the engine room is usually a model of mechanical perfection. Among the important duties of the engineer is to see that this machinery is kept in first class condition and above all scrupulously clean. One of the greatest aids in doing this is to have the machinery housed in a room, the floors and walls of which can be easily kept spotless. Cement, for instance, although one of the greatest of modern building materials, does not make a good floor or wall covering because it is more or less porous, wears rough and the countless small crevices on its surface become clogged with foreign material and filth of all kinds, which is virtually impossible to remove.

The decorative and artistic properties of tiling, although not so essential in an engine room as in other places, are nevertheless of considerable importance. There is something of magnificent dignity about gigantic modern machinery, and it should be housed in a room, the attractive appearance of which is commensurate with this dignity. Furthermore, the moral effect of attractive looking floors and walls should not be underestimated. An attractive appearing room offers a strong inducement to the men in charge of the machinery to live up to the appearance of their surroundings, and keep their engines in the same immaculate condition, as far as cleanliness is concerned, as is the room in which they work.

These numerous considerations have been taken into account by many builders of high-class power plants, who now realize that the slight increase in the initial expense of the tiling of the floors and walls of the engine room is in the end a permanent economy and a wise investment.

WASHINGTON, D. C. C. J. FOX, PH. D.

NEW USE FOR A GASOLINE LIGHTING PLANT.

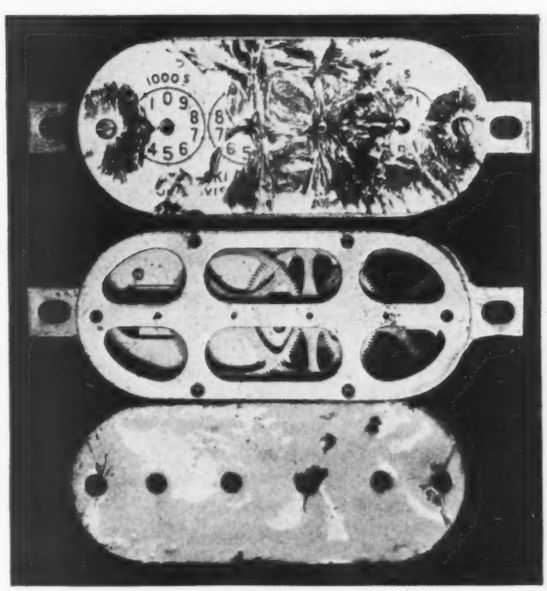
It seems that the insurance companies must be fond of meeting losses due to gasoline lighting plants, as they are still taking risks on stores using gasoline at the same rate as stores lighted by electricity. The latest use of such systems is reported from an Iowa town as follows:

A merchant who was using gasoline lighting decided that he would rather have the insurance called for by his policy (with permit attached) proceeded to extinguish his gas, but made sure that the generator was left turned on; he then lit an oil lamp to be left as an all-night lamp, locked his doors and went home. There was, of course, something doing in due time as the insurance company became aware. The store room was set ablaze all over the inside at the same time. However, the insurance companies are still looking for business at the same rate regardless of the source of light used.

LAKE CITY, IA. OTTO E. BROWNELL.

A METER INJURED BY LIGHTNING.

The accompanying illustration shows the dial face of a Westinghouse watt-hour meter (5 amperes, 200 volts), injured from lightning which struck the overhead network of wires about 1000 ft. from the meter. The meter was inside a wooden structure of one floor, with a corrugated iron



METER INJURED BY LIGHTNING.

roof, well grounded by water and vent pipes. It was installed on a dry side wall, was insulated with one-inch porcelain knob insulators and was 10 or 12 ft. from any ground conducting body. The house is one of the nearest to the bay water edge.

The porcelain dial being enameled was insulated from the body of the meter. The dial hands were fused, and the por-

celain chipped off mostly underneath the hands, and at the screws holding the dial in position. The glass face in front of dials was not broken. The revolving disk was slightly bent, but the windings of the meter were uninjured.

MANILA, P. I. C. H. HULBERT.

A MODERN INEXPENSIVE SYSTEM OF OILING HIGH-SPEED UNITS.

The oiling of high-speed units correctly is a problem that is receiving serious attention from various manufacturers and mechanicians. Many methods are employed to oil automatically the bearings, and as a matter of business, the system or method which involves the least amount of cost in erection and requires the minimum amount of attention is the one in most cases adopted. Oiling by hand is now seldom employed and in modern plants this system is considered obsolete. Oiling by gravity is a system that is used in numerous places and another method also used considerably is known as the direct system. In this system the oil is discharged through piping to each bearing by means of a pump that is actuated from a rocker shaft or other convenient connection on the engine. The oil after being fed through the bearings flows back by gravity into the oil well, where it is again taken by the pump and discharged through the different bearings. This cycle of oiling continues as long as the engine runs or until the water of condensation accumulates in the oil well, when the pump will discharge this water through the different bearings.

With the system illustrated in Fig. 1, it is impossible under ordinary conditions to have the supply of oil cease. This system of oiling can be erected at a very moderate cost and where trouble is experienced with other methods of oiling it will be found expedient to adopt this plan. In Fig. 1, T is a cylindrical tank made from a piece of steam pipe; the size of the tank being proportional to the amount of oil required for a given run. Thus, if the engines should require one-half barrel of oil during the run, the tank T can be made large enough to contain this amount of oil, or more. The pipe from which T is made can be about 4 or 5 ft. in length and 12 or 14 ins. in diameter, capped at both ends and placed in a vertical position as shown. Pipe W is connected to some source of water supply and pipe M is connected to a waste pipe or sewer. Pipe P is connected to the oil tank T' and pipes N are connected with the various oil cups and bearings of the different engines. Valve V is provided for the purpose of washing out tank T whenever necessary. The oil filter F is elevated above the open oil tank T' and as the oil runs back from the bearings it is deposited in this filter, and thence into tank T'. Tanks T and T' are fitted with gauge glasses to enable the engineer to see the amount of oil they contain. To operate this oiling system, pour a barrel of oil into tank T' and fill tank T with water by opening valve A. When T is full of water, shut A, open valve B, and open valve C. The water flowing out through M induces a vacuum in pipe P and thus draws the oil into tank T. The oil pipe P extends almost to the bottom of T' and the opening of this pipe is protected by a wire screen to prevent any foreign matter from entering tank T. When sufficient oil is drawn into T, shut valves B and C and open valve A. Water pressure will now be exerted on the oil and by opening valve D, the oil will be forced through the various pipes that are connected on the different bearings. To stop the system from oiling, shut valves A and D. No more oil will be circulated after those valves

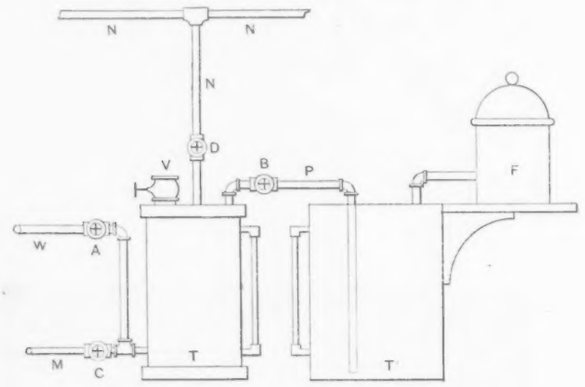


FIG. 1.—OILING SYSTEM FOR HIGH-SPEED ENGINES.

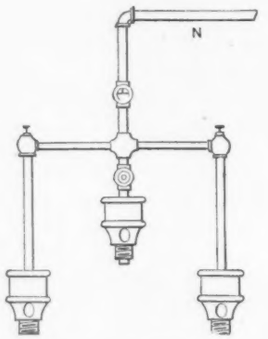


FIG. 2.—OILING ARRANGEMENT FOR CRANK PIN AND MAIN BEARINGS.

are closed and if sufficient oil remains in tank T for the following run it will be only necessary to open valves A and D, when the oil will again begin circulating through the various feed pipes.

Fig. 2 shows the method of connecting the pipes to the crank pin and main bearings. This method is also employed in supplying the oil cups for the crosshead and slide. It will be seen from the drawing that the oil is fed directly to the cups and by properly manipulating the small valves as shown, a constant supply of oil is insured. It will be understood that the oil supply pipes extend through the caps to the cups, holes being drilled for this purpose. The oil is fed from the cups in the usual manner and should the cups refuse to feed oil for any reason the constant supply entering through the pipes will overflow and run down the outside of the cups and into the bearings thus insuring a double feed, hence a hot bearing from this system of oiling is a remote possibility. Should the cups need cleaning, it will be only necessary to lift out the pipes and screw out the cups for this purpose.

BUFFALO, N. Y. KINGSLEY WILLIAMS.

STARTING A TWO-PHASE ALTERNATOR AS A SYNCHRONOUS MOTOR.

A very interesting, and at first, a very puzzling phenomenon occurred recently in an attempt to start up a two-phase alternator as a synchronous motor. Two similar 150-kw alternators were at hand and it was desired to start one as a motor from the other running as a generator. Accordingly a variable resistance was put in series in each phase of the motor circuit and the voltage of the generator was slowly raised. A large current was indicated on all four ammeters, which was not interrupted in the least when the circuits were entirely broken at the variable resistances. This phenomenon was very puzzling until the armatures of the machines were tested out

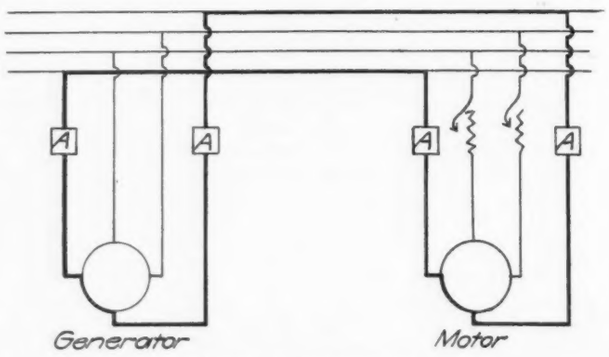


DIAGRAM OF CONNECTIONS.

and found to be continuously wound. The solution was then simple enough, as shown by the accompanying diagram. The four ammeters were all indicating the same current which flowed through a quarter of each armature. The circuit is shown in heavy lines. By using instead, a generator with two separate windings, the difficulty at first experienced was overcome, and the motor satisfactorily started. Had the resistances been inserted in the other two leads, the current would not have been observed until it had demonstrated itself in the blowing of fuses or circuit breakers.

COLUMBUS, GA. E. RAY SHEPARD.

THE TOOL CHEST AND THE MECHANIC.

Mr. Charles L. Rafferty, under the above caption, in the first issue in June, hands a whole basket of lemons to those mechanics who have seen fit to purchase more tools for their chests than Mr. Rafferty thinks is necessary for an able workman to own. As I am foreman in a manufacturing machine shop (notwithstanding the fact that I am the fortunate possessor of three tool chests full of tools), and am in constant touch with mechanics, I feel that it is my duty to dispel a little of the halo of mystery with which Mr. Rafferty has surrounded the "genuine article—the real mechanic."

He says that "any able mechanic will, of course, have the fundamental tools required in the proper execution of his work." Just what tools may be classed as "fundamental" is largely a matter of opinion and environment. Tools that would enable a man to work the year through without borrowing, in a shop manufacturing textile finishing machinery for instance, would be of hardly any service in a shop where the product was typewriters or sewing machines. Take my own shop, where we make wire stitchers of "Boston" quality and the man without tools must buy, borrow, or steal, for without good tools he cannot possibly keep up his end.

I suppose that Mr. Rafferty's mechanic of ability would come right in with a hammer, monkey wrench and two-foot rule and a large quantity of self-reliance and hold our work up to the half-thousandth limit, which is necessary in some parts. Perhaps he would, but none has arrived to date.

Some come in bearing all the Rafferty earmarks, including the hammer and monkey wrench, which latter tool, being built along the same general lines as a vernier caliper, could no doubt be substituted for one, provided the owner of same was an "experienced mechanic" of the Rafferty type.

As a matter of fact, we do have to loan many of the men tools which we would prefer not to leave our own hands because of the abuse they might receive; but if the men make good, they generally purchase the required tools themselves as soon as they see the necessity for doing so.

Now to get back to Mr. Rafferty's first statement concerning the policy of first trying a mechanic with a view to discovering his worth, I beg to say that it is not an "expensive process" if properly conducted and is certainly "practicable," and furthermore, it has been done in every shop in which the writer has ever worked. I wish to say further that if the material on which I tried out new men was "total waste," it would not be long before there would be a man about my size, tool chests and all, looking for a job.

That Mr. Rafferty's "electrician" was allowed to work three days on a "special job" before his "disgusted employer" discovered that he was no good, speaks very highly for the said disgusted employer's powers of observation.

If I too might be allowed to "reflect for inspiration," I can recall but one instance in my experience of an unskilled mechanic following the trade who was not a walking delegate for a labor union, and this one requested the loan of a "tin rule" about 20 minutes after he began work, because the two-foot wood affair he carried was too far gone to read anything from finer than inches.

My experience with skilled labor has always proved that mechanics cannot be judged by either clothes or tools, but by results alone. Some fine workmen never own a decent set of tools and depend on the kindness of their acquaintances for what they need, while others equally fine have excellent sets and know how to use them to the best advantage. Therefore I say give every man you employ a square deal and a chance to make good, but do not leave him to his own devices for a week with a thousand dollars worth of part-finished product to work on, with which he is entirely unfamiliar and then blame him for spoiled work.

EAST GREENWICH, R. I. L. L. ARNOLD.

CUTTING AND FITTING STEAM PACKING.

It certainly seems to be a very easy matter to cut a piece out of a sheet of packing and place it between two flanges which are to be fastened together by means of bolts. As simple as the matter seems, some people make very hard work of it, not only spoiling much packing, but the job when finished is far

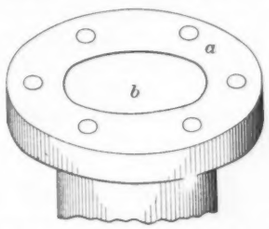


FIG. 1.—FLANGE TO BE FITTED WITH GASKET.

from being steam tight. Recently the writer watched a man attempting to cut a piece of steam packing from a sheet of the material. The man first marked out the shape with a pencil and then attempted to cut the packing with a knife. Such work should be discouraged. The proper way to cut steam packing is with a hammer. To illustrate: Let Fig. 1 represent a flange to be fitted with a gasket. The hole, *b*, is a steam pipe opening, while holes *a*, *a*, are for bolts which fasten the flanges together. Some mechanics first mark out a paper pattern, then transfer the pattern to the sheet of packing and laboriously mark the packing with a pencil and finally cut out the gasket with a penknife. This is a waste of time and of material. A much better way of cutting packing is shown by

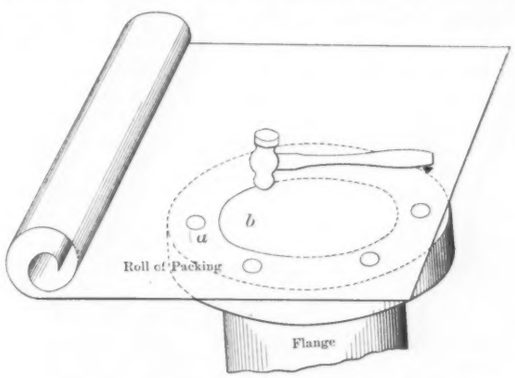


FIG. 2.—CUTTING PACKING FOR A GASKET.

Fig. 2. Here the sheet is unrolled upon the flange, held in place by the fingers of the left hand, while the ball pene of a machinist's hammer is applied as shown at *c*. A hole already made, is represented at *a*. As fast as the packing is hammered through it drops into the opening and after a few inches have been cut, the packing holds the sheet in place, so there is very little trouble in preventing its slipping around on the flange, especially after the first hole has been cut. As simple as the matter seems, there is one right way and several wrong ways of doing the work.

Care should be taken not to hammer the packing to pieces. Fig. 3 represents very bad practice, the edge of the packing adjacent to the holes being hammered into shreds as shown. It will be noticed in this engraving that the face of the hammer is being used for cutting the packing instead of

the ball pene as noted elsewhere. The hammer is laid too flat upon the packing. This arrangement can only result in damaging the edge of the packing next to the hole. In pieces where the surface to be covered is very narrow there is danger that the packing will be so badly destroyed that it will permit steam to pass through between the fibers of the material.

Fig. 2 shows how to do the cutting properly. The ball pene of the hammer is used—an ordinary blacksmith's forging hammer—and each blow is struck at an angle of 45 deg. with the face of the flange and the surface of the packing, so that the force of each blow comes upon the sharp corner of the casting under the gasket, which is cut in two almost as clean as could be done with a pair of scissors. There is no danger of fraying or otherwise spoiling the edge of the gasket when it is cut in this manner.

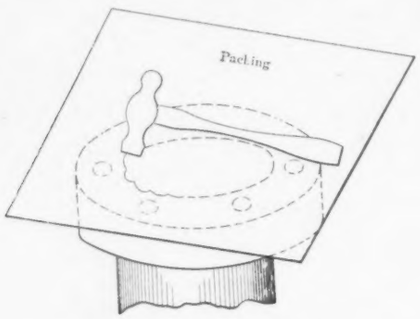


FIG. 3.—WRONG WAY TO CUT GASKETS.

Some users or owners of machinery seem to think that almost any kind of packing will work on almost any surface, but they are apt to be mistaken, as the results show, when packing blows out of one joint, while the same kind of material stays in another joint. One is fitted for its work, the other is not.

Fig. 4 shows a very hard place for packing—that is, the water end of a duplex steam pump. The space *a* is some distance from any supporting bolt and it is also very narrow. A great deal of trouble was experienced by the packing blowing out across this narrow space. The first time the writer saw this pump, it had been packed by a man who cut the packing with the large face of a hammer. The narrow neck of packing at *a* had been almost completely hammered to pieces during the cutting act, the hammer blows showing entirely across the strip of packing from one hole to the other. The strength of the stuff, over the long space between the bolts *b* and *c*, caused

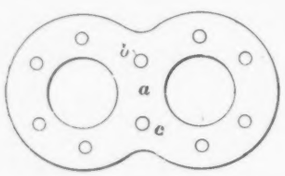


FIG. 4.—WATER END OF DUPLEX PUMP.

the packing to be poorly supported and to move each way slightly under the steam pressure as it was applied alternately from one side of the packing and the other in the working of the pump.

A clean-cut packing, by the ball pene hammer, cured the trouble entirely. When a piece of packing of this character is necessary, it is the custom of the writer to move the packing slightly when cutting along the sides between the holes. Care should be taken to move the packing in the right way to leave it a little wider than the space it is to cover. If there is nothing to prevent, the packing may well be left ¼ in. or ⅜ in. wider than the space; then, when pressure is applied to the packing, that portion which hangs over the edge of the metal soon becomes swollen and thicker than the rest of the packing, and aids materially in keeping it in place between the bolt holes.

It is the custom of some engineers, when there is trouble in molding a piece of packing of this kind, to reinforce it by laying into the joint a strip of corset steel a few inches long. This acts in two ways. It not only serves to anchor the packing in place, but the steel reinforces the thickness of the packing right where there is need of it.

New York City. John Jackson.

CONNECTING A RECORDING WATTMETER TO A SWITCHBOARD.

In a power plant connected to a manufacturing establishment, it is desirable to keep the plant in operation during working hours and if additions are desired to the plant or switchboard, it is important to make these at a time that will least interfere with regular operation. At the plant where the writer installed a Bristol recording wattmeter, there were in operation two 100-kw, 250-volt generators and one 75-kw unit having the same potential. It was necessary to install the wattmeter without interfering with the regular generation of electricity, which was used for lighting the factory and operating over 100 motors of all kinds, and used for various purposes. If the meter were connected on the main switchboard, it would involve the drilling of three holes for the instrument and two for the resistance, and also the cutting of one bus-bar and the drilling of holes in it for the connection of the terminals, not to mention the various other connections. The amount of time in which to complete the work was limited and the plan finally adopted was as follows: A slate slab of sufficient size and similar to those in the main board was obtained and drilled to receive the bus-bar bolts and terminals of the meter. Holes were also drilled for the legs which were to support the slab and for the wattmeter resistance. Flat copper bars

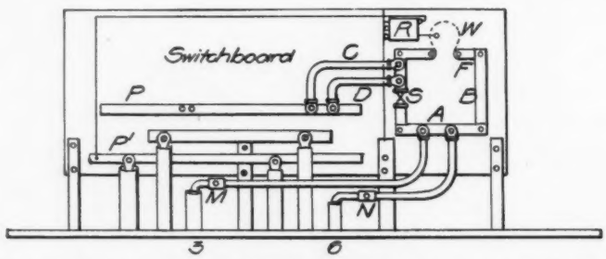


FIG. 1.—CONNECTING A RECORDING WATTMETER TO A SWITCHBOARD.

2½ ins. in width and ½ in. thick were cut to fit the required dimensions and drilled to receive the bus-bar bolts, terminals of the recording wattmeter and leads from the generators. The separate slab with the meter, bus-bars and resistance connected in position was then erected beside the main board and when an opportune time presented itself the leads from the generators were connected to the wattmeter bus-bars as shown at *A* in Fig. 1. Referring to this sketch, it will be seen that leads 3 and 6 from the dynamos are connected to the bus *A* which is connected to one terminal of the wattmeter through the medium of the bus-bars *B* and *F;* the other terminal being connected to bus-bar *P* by means of cables *C* and *D*. These latter cables being somewhat lighter than those at *M* or *N*, it was considered expedient to employ two of these in this connection. A single-pole switch was connected at *S*, so that if repairs or inspection of the wattmeter were required, the switch could be closed. The resistance which accompanies the wattmeter is shown bolted to the same slab as the wattmeter

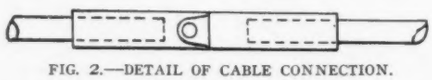


FIG. 2.—DETAIL OF CABLE CONNECTION.

at *R*. The meter is connected to this resistance and the latter is in turn connected to the bus-bar P^1. Thus it will be seen that the wattmeter has its potential coils properly connected. The back of the switchboard is shown in the engraving and the current flows through the leads 3 and 6, cables *M* and *N*, wattmeter *W* and out on *P*. Fig. 2 shows how the cables from the generators are connected to the cables connecting with bus-bar *A*. Solid brass lugs were cast of sufficient diameter

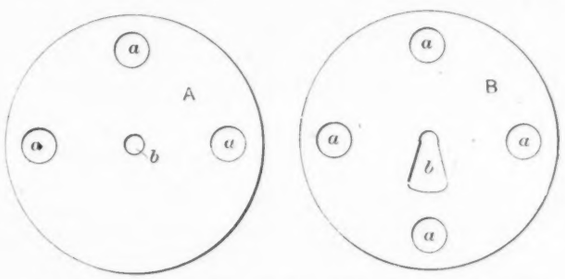
to receive the 1-in. cables leading from the dynamos. The lugs were drilled to receive connecting bolts and were also bored to receive the leads. The lugs after being bored were heated and filled with melted babbitt metal and the ends of the cables were then forced down into it and allowed to cool. In this way the cables *M* and *N* were connected to 3 and 6 and bus-bars *A* and *P*. Before the cable ends were inserted in the brass lugs, they were cleaned and tinned, then heated and inserted as before described. After cooling, the lugs were tested for loose connections by placing them in a vise and endeavoring to twist the cables free. One lug was found defective, and, of course, was resoldered.

NEW YORK CITY. W. KAVANAGH.

METAL CUTTING BY STEAM.

An engineer of the writer's acquaintance recently complained that steam cut out numerous valves in his engine room. He stated that over a dozen different valves in various parts of the establishment had to be renewed every year on account of cutting of the disks or the seats. The writer was rather skeptical in regard to this matter, whereupon the engineer produced sundry valves, the seats and disks of which had been grooved out in most erratic fashion. The engineer claimed that the cutting was done by the passage of steam and proceeded to set forth in detail the particulars concerning the cutting of the valves. The writer took occasion to state to the engineer that while he had seen many cases of metal cutting by water and by dirt, he never knew of a case where steam had worn away any of the metal.

After considerable discussion, it was decided by the engineer and the writer to put the matter to test. To this end, a ¾-in. pipe was selected where it was known that a good deal of water would pass through from time to time, on account of the drainage of a long line of pipe which passed through the particular pipe selected. Another pipe was selected, or rather erected, for the test, through which no water could possibly pass. The pipe



FIGS. 1 AND 2.—SHEET IRON DIAPHRAGM CUT BY WATER.

where the water was expected to pass was used for delivering steam to several glue-pots where glue was heated. The pipe passed near the floor of the factory. The pipe which was arranged so as not to pass any water was taken direct from the top of the boiler for the purpose of the test to be made.

This pipe passed vertically upward about four feet, then horizontally a dozen feet or more, from which point it descended vertically to a trap in the lower part of the building. At the point where the pipe dropped to the trap, a tee was placed and a valve and nipple opened direct into the atmosphere. This opening was bushed down to ⅛ in. in diameter and was left open for six hours a day for six weeks. A couple of bolted flange unions were placed, one in each of the pipes above mentioned, the couplings being introduced where the pipes ran horizontally. Between the flanges were placed, in each union, a disk of thin sheet iron, and a 1⅛-in. hole was drilled directly in the center of the thin piece of metal.

When the unions were made up in the pipe, the holes came directly in the center of each union. At the expiration of the time allowed for the test the unions were disconnected and the thin metal plates removed. The plate in the upper pipe where nothing but steam could pass was found to be intact. The hole was ⅛ in. in diameter and was just as round as when the metal was put into the union. The other plate, the one in the glue heater supply pipe, was found to be badly cut. The upper portion of the hole was as round as when originally drilled. The lower portion, however, was cut in a peculiar manner; the enlargement began about the middle of the hole and became larger toward the bottom, where it was two or three times the diameter of the hole originally drilled in the pipe. To the writer this was conclusive evidence that the cutting was done by water and not by steam.

The writer was still further corroborated in his assertion by the appearance of certain valves, the seats and disks of which had been cut to pieces while in use by the passage of steam; so it is alleged by several engineers. These valves showed that water and not steam did the cutting, for, in every case, the lower side of the valve was found to be cut, and that portion of the disk which was above the water line—when the valve was lying on its side while in use—was found to be almost entirely free from any cutting action whatever. The disks of the valves, being free to turn, were cut in any old place.

The engravings herewith illustrate the manner in which the disks were made and one of them cut by the water which was carried along by the steam. Both diaphragms were exactly alike when placed in the pipes. The one in the steam, came out exactly as it went in. The other diaphragm came out as shown; the orifice *b* being enlarged many times, and in a downward direction only. It is pretty safe to claim that of the cutting and wear in steam engine valves and cylinders, nine-tenths of it is due to the presence and passage of water over the parts.

WILLOUGHBY, OHIO. JAMES F. HOBART.

CLEANLINESS IN THE DYNAMO ROOM.

Dirt anywhere out of its proper place is objectionable, but I do not believe there is any other machine in which dirt is as troublesome as in the dynamo or motor, or in fact, any electrical machine. I recently took charge of a plant having one 150-kw and one 75-kw, two-phase generators delivering current at 2200 volts. During the first week of my service I was compelled to work until midnight myself on account of the peak load and the absence of my assistant for that watch. The first night, about 10 o'clock, I started the small engine driving the 75-kw machine and after bringing up to speed could not get the generator to "pick up." Cutting in all resistance I made an examination, going first to the exciter, and found two of the brushes stuck up in the holders and entirely out of contact with the commutator. I loosened the brushes and the machine got to work at once. Needless to say, before the machine was started again I removed the dirt and obtained fully two gallons of dirt from the armature and fields. The brushes were so gummed up I could hardly remove them from the holders. There had been on both machines heavy sparking. The commutators on the exciters ran in a ring of fire, and the temperature of the machines was very high with only moderate loads.

I inaugurated a campaign of inspecting and cleaning, doing the work myself. In cleaning up this plant I had to wallow around in grease and dirt like a rat. I found switchboard connections loose, and tightened them up, then smoothed up commutators and fitted brushes properly and the machines run cool and without sparking. So much for cleanliness. No "expert" work at all, just what we might call "flunky" work. It is with the greatest difficulty that we can get assistants to do this easy, and yet most important, work.

I was recently called to examine a small dynamo which had refused to work. It was a compound-wound machine. I found the collector rings grounded to the shaft of the machine *by dirt*. I cleaned this off in about one and one-half hours and had the machine running nicely. My work cost $10, and should have been done by any assistant having good sense and a little experience at no extra cost whatever. About two months later the machine was burned out from the same cause. It is my belief that nine-tenths of the trouble experienced with dynamos is due to dirt.

ST. LOUIS, MO. WILLIAM EASTMEAD.

QUESTIONS AND ANSWERS.

Will you kindly advise us if it is possible to use uninsulated aluminum wire for winding magnets? S. U. J. M. Co.

For moderate voltages, the natural oxide which forms upon the aluminum wire furnishes sufficient insulation for the purpose mentioned. The chief difficulty in the use of aluminum wire is that it cannot be soldered easily by ordinary methods, although there are many fluxes on the market which are claimed to be reliable for this purpose. For voltages over 200, paper should be wound between the layers.

I have been told that two single-phase, 133-cycle, 2200-volt alternators cannot be run in parallel. Why cannot this be done? C. A. S.

The parallel operation of 133-cycle alternators is not impossible; but owing to the imperfections in the governing powers of the small engines to which such alternators are usually attached, this is not always possible. Where the alternators are driven from water-wheels better results are usually obtained. The fault is not in the alternators; but in the prime movers driving them.

Kindly inform me how the size of a safety valve may be found for a boiler using gas instead of coal as fuel? E. H.

The only logical way to ascertain the size of safety valve required is to estimate the pounds of steam per hour the boiler can produce and then make the area of the safety-valve opening such that it will discharge steam at that rate. We would suggest, however, that you communicate with the authorities under whose supervision the boiler would naturally come for inspection, regarding the matter.

We desire to run a bellows by means of an electric motor, and only single-phase current is available. What is the best arrangement under the conditions? S. B.

The best type of single-phase motor for the purpose is one having an auxiliary stator winding. The ordinary single-phase induction motor is not self-starting under load. In the former arrangement, the auxiliary winding is only used while starting, being cut out when the motor has attained its full speed. If the motor is to be started and stopped quite frequently, it is preferable to have some shifting devices arranged so that the motor may operate continuously.

I have an alternating-current fan motor circuit which I desire to run during the day; but inasmuch as the load is so small and the alternator so large it is out of the question to run the alternator. Could not a 5-hp induction motor be used for this purpose if run as an alternator; and if so, how may this be run as an alternating-current generator? H. K.

An induction motor driven above synchronous speed and having its field excited from an alternating-current source, will act as an alternating-current generator. Being without an alternating-current source, however, it would be impossible to operate the induction motor as a generator without rebuilding it. It would be cheaper and more satisfactory to buy a small alternator for this purpose.

Please give me the answer to the following question and the formula by which it is derived: What size cable is necessary to carry 650 amperes, 5250 feet with 250 volts at the generating end, the line to have a 10 per cent drop? J. K. K.

The formula for ascertaining the size of cable is as follows:

$$A = 11 \times I \times D \div v$$

where A is the circular mils; D, the distance in feet both ways between the points in question; v, the volts to be lost in the line; I, the current in amperes carried by the wire, and 11, a constant, being the resistance of one mil-foot of copper wire at 75 Fahr. Substituting the values in the formula, the size of cable in circular mils is found to be 3,003,000.

Why is it necessary to have moving parts in a frequency changer? Would not a stator wound for 24 poles and an immovable rotor wound for 10 poles transform from 60 cycles to 25 cycles? A. R. T.

When the stator of an induction motor is wound for say, 24 poles, or in fact for any number of poles, and the rotor is stationary, the frequency of any e. m. f. produced in any conductor connected in any way for any number of poles will be the same as the frequency impressed upon the primary circuit. An induction motor can, however, be used as a frequency converter for changing from 60 cycles to 25 cycles by winding the two elements with the same number of poles and driving the rotor at 25/60ths of the synchronous speed.

In an alternating-current system, if the lamps and motors connected to the secondary of a transformer are cut out of circuit, will the primary still draw current from the alternator? H. H. C. B. Co.

The amount of current passing through the primary winding under the conditions noted would vary from one to five per cent depending on the full-load efficiency of the transformer. This small amount of current causes repeated reversals on magnetic flux through the iron core and these reversals of magnetic flux induce electromotive forces in both coils. The electromotive force thus induced in the primary coil is opposite in direction and very nearly equal to the electromotive force applied to the primary coil. Only the difference between the applied electromotive force and the opposing induced electromotive force is available for producing current through the primary coil and since this difference is small, the primary current at no load is also small.

In the formula for calculating the voltage drop in a circuit given in the Questions and Answers column of the April number, where does the 22 come from? Or is this a typographical error? Please give a formula for finding the carrying capacity in amperes of a conductor. J. A. G.

The resistance of a mil-foot of commercial copper, that is a wire having a cross-section of one circular mil and a length of one foot, is taken as 10.8 at ordinary temperatures. As there is no need for such refinement in wiring calculations, the value is usually taken as 11 ohms. There being two wires to a circuit, it would be necessary to multiply the distance by two; but where the formula specifies the distance one way, the constant is doubled instead, hence the 22. The permissible current in amperes which a wire may carry is fixed by the National Board of Fire Underwriters, and a table of current-carrying capacities may be found in any hand book or in the National Electric Code. Kennelly's formula for ascertaining the heating of bare copper conductors suspended in still air by a current is as follows:

$$T^\circ = \frac{I^2}{d^3} \times 90{,}000 + t^\circ$$

where T°, is the temperature of wire in F°; t°, the temperature of air in F°; I, the current in amperes, and d, the diameter of the wire in mils.

What causes the enormous rise of the secondary voltage of a series transformer if the secondary circuit be opened while the transformer is in service? F. L.

An article in our issue of Sept. 1, 1906, goes quite fully into the operation of the series transformer. When the secondary of such a transformer is on short circuit, a considerable current flows in the secondary circuit and the magnetomotive force of this current is opposed to that of the primary current so that the flux which is produced by the resultant of these two magnetomotive forces is small in value; being just equal to the amount necessary to generate an electromotive force sufficient to produce the required secondary current in the local secondary impedance. Thus under normal operation, the secondary current is practically equal to the primary current and the flux is extremely small in value. If the secondary circuit be opened and the primary current continues to have its former value, the flux in the core increases enormously because there is no magnetomotive force to oppose the primary magnetomotive force. The secondary electromotive force varies directly with the flux so when the secondary circuit is opened the voltage across its terminals is extremely large. It is noteworthy moreover that the voltage across the primary terminals will be correspondingly large, and that the series transformer with its secondary circuit open interposes a considerable impedance in the circuit.

CENTRAL STATION SALE OF CURRENT

Report on a Uniform System of Accounting for Electric Light Companies.

At its Washington convention, the National Electric Light Association heard the first report of its committee on "A Uniform System of Accounting for Electric Light Companies." This committee consisted of Mr. H. M. Edwards, chairman, auditor, New York Edison Company; Mr. A. S. Knight, Edison Electric Illuminating Company, Boston; Mr. G. W. Curran, assistant general agent, United Gas & Improvement Company, Philadelphia; Mr. C. N. Jelliffe, auditor, American Light & Traction Company, New York; and Mr. Paul R. Jones, auditor, Henry L. Doherty & Company, New York.

It is manifestly impossible here to give the full report of this committee with its blanks and forms, but the general classification can be given and those desiring the report more in detail are referred to the original document, obtainable from the offices of the National Electric Light Association, 33 W. Thirty-Ninth Street, New York. No final action was taken on the report, but the committee was continued.

The report is devoted to the discussion of the following subjects, viz.:

General accounts, with form of balance sheets; construction accounts; operating accounts, with form of expense report; income accounts, with form of summary of operation report.

To carry out the scheme of accounting recommended, the following records subsidiary to the general ledger are necessary:

Consumers' ledger, containing an account with each customer and a detail of the bill rendered. Abstract of expenditure, showing the amount of each debt incurred and in adjoining columns the account to be charged. Operating ledger, containing an account with each sub-classification of the operating expenses. Investment ledger, containing an account with each construction account. Accounts payable ledger, containing an account with each dealer.

A balance taken from the consumers' ledger should equal the balance appearing on "Accounts Receivable" in the general ledger; a balance taken from the operating ledger should agree with the amount of the "Operating Expense Account" in the general ledger; a balance taken from the "Investment Ledger" should agree with the amount of the "Plant and Property Account" in the general ledger; and a balance of the accounts payable ledger should agree with the amount of "Accounts Payable" in the general ledger. Some of the above records may be consolidated where the volume of the transactions does not warrant so diversified a system.

CONSTRUCTION AND PROPERTY ACCOUNTS.

Organization: Cost of effecting organization and such capital exploit expenses as may be properly connected therewith.

Royalties, Franchise and License: Royalties or licenses paid to licensors, payments to city, town or state for franchises (other than taxes) or on capitalization and rights of way, easements, etc.

Generating Plant—Steam: Real estate, station structure, steam and electrical plant and all apparatus and devices, to generate electricity and conduct same to the terminal board in the station.

Generating plant—Gas: Real estate, station structure, gas making apparatus, gas engines, and all apparatus and devices to generate electricity and conduct same to the terminal board in the station.

Transmission plant: Subways, overhead lines, conductors, sub-station real estate and buildings, converting apparatus and devices in sub-station to transform electric current and deliver same to the distributing system.

Storage Batteries: Including compensators and boosters, and real estate and buildings, if latter are devoted to this purpose exclusively.

Distribution Plant: Subways, overhead lines, feeders and mains, house services and all apparatus and devices to deliver electricity to customer's premises.

Arc Lamps.

Converters.

Meters.

Municipal Street Lighting: Lamp posts, services and cost of installation of system ready to light lamps.

Furniture and Fixtures: In general and branch offices.

General Office and Branches: Real estate, buildings and appointments.

Miscellaneous Equipment: Coal storage facilities, repair shop, store rooms, laboratories and apparatus, tools and instruments.

OPERATING ACCOUNTS.

1. *Generation—Steam:* Cost of electricity delivered to station terminal board.
2. *Generation—Hydraulic.*
3. *Generation—Gas Eng.*
4. *Transmission:* Cost of conducting electricity to substations and cost of delivering to distribution system.
5. *Storage Battery:* Cost of storage, including depreciation.
6. *Distribution:* Cost of conducting electricity from substation terminal board to customers' premises and metering same therein.
7. *Consumers:* Costs in customers' premises.
8. *Municipal Street Lighting:* Cost of operation of street lighting system.
9. *Technical:* Costs in laboratory, draughting room, engineering, testing and all investigation and engineering exploit expenses which may not be pro-rated over any of the foregoing classifications or charged to construction.
10. *Depreciation:* The amount which may be appropriated for this purpose.
11. *New Business:* Canvassing, advertising, free wiring, signs and all expenses in connection with securing business.
12. *Commercial:* All office expenses in connection with customers' accounts, reading meters, rendering bills, collection bureau, bill question work, installation and contract records, bad debts.
13. *General:* Administrative and miscellaneous.

Under operating accounts the reports give index and sub-index numbers for different items, which enable a company to carry its sub-division of accounts as far as may be desired.

INCOME CLASSIFICATION.

Sale of Electricity: Commercial Lighting, Commercial Power, Municipal Street Lighting Arc, Municipal Street Lighting Incandescent, Municipal Building Lighting, Sales to other Public Service Corporations.

Profit on Merchandise Sales.

Rents from Real Estate.

Interest and Dividends from Investments.

Solicitation of Motor Load.

In a paper presented at the Washington convention of the National Electric Light Association, Mr. George N. Tidd took up the subject of increasing the central station motor load. He pointed out that an examination of the steam plant of the average manufacturer will show many examples of poor steam engineering and a high cost of energy delivered for actual production. One will usually find they are using comparatively expensive coal and frequently teaming the coal in and the ash out. They are probably purchasing their water from the city and feeding it to the boilers with injectors. The boilers are frequently poorly set and operating at poor efficiency. The en-

gines are probably of inferior design, old and in poor condition; usually slide-valve or high-speed automatic, and in many instances either over or under-loaded.

The frictional load of shafts and belts frequently will represent 20 to 50 per cent of the power produced. Their labor cost will be high when considering the amount of power actually consumed in producing useful work. It would therefore appear that with high-efficiency generating plants, methods of burning low-grade fuels, low labor costs (due to large outputs and labor-saving devices), together with the savings one can secure by the elimination of a larger portion of the frictional line losses due to motor drive, one should take over all the power business of the district, and not be confined to a comparatively few short-hour, low-load-factor class of consumers. Among the methods suggested for attaining this desired end are the following:

Solicitors.—Secure the services of a good operating engineer for the work, a man, if possible, who has been in charge of a central-station plant, and one who can appreciate quickly the points involved in good and poor steam engineering. This man should be a good salesman, and with one or more assistants, can cover a good deal of ground by devoting his entire attention to the work. There are many men operating the smaller plants who are admirably adapted for the work. The varied experiences secured by such men in operating these plants, with the numerous difficulties encountered and overcome every day, make them particularly resourceful and valuable for the work.

Canvass of District.—Have your power man make a thorough investigation of every power-producing plant in the district, no matter how large or small. Keep a systematic record of every case along lines suggested in plant data sheet herewith shown. A thorough study of each motor problem should be made, which, supplemented with a study of the process of manufacture, will develop business that at first sight would be deemed impracticable to secure, owing to steam or fuel conditions. This analysis prepares the representative to meet the owner or manager, in a measure, upon his own ground, and having a close approximation to the total costs of the plant, conditions of operation and load-factors, puts him in a position where he can talk and argue most effectively. His grasp of the situation is tremendously increased. These records are invaluable, as in some instances it is not possible to close a prospect until he has a break-down, and when it comes all the data are instantly available.

Securing a Large Representative Installation.—The first large customer comes hard. After the ice is broken, others have more confidence in your proposition and are easier to handle. It will therefore be of great aid to secure one of these customers to whom you can send and take prospects. The customer should if possible be one of the leading manufacturers. There are always one or more manufacturers in a district who are naturally the leaders, and others are very apt to consider whatever *they* do the proper thing. Make the most important manufacturer your friend and a booster; make his installation a model one and you will find his aid invaluable. There is nothing so effective in arousing the interest and desire of a prospect as having him examine and see a large installation in operation, and talk with the owner or manager on the many advantages over the old steam drive.

Trial Demonstration.—One frequently meets prospects who are dubious as to the advantages of central-station drive in their particular business or conditions. In these cases, I would install the complete equipment and furnish electricity to operate for 60 or 90 days' trial. Usually they will agree to pay a nominal sum, representing their acknowledged costs for the service and in many instances will further agree to provide the motor foundations and belts. Under these conditions the expense of such a trial is merely nominal, as all the apparatus can be removed and used elsewhere. Fully 95 per cent of these trial installations are finally closed.

Methods of Selling.—Be liberal with your prospects in regard to terms of payment for the motors. In many instances it is advisable to sell on the instalment plan and allow one or two years to pay for the installation. The small manufacturer especially needs the money in his business and cannot afford to make the necessary outlay in cash for the proper installation. By taking a lease upon the apparatus and insuring it against fire, you are pretty well protected. In some instances it may be necessary to install a motor free, if it secures a particularly favorable business. The rate per kw-hour can be easily increased enough to cover the cost of the motor. In other words, allow nothing to stand in the way in the line of a reasonable investment in securing good motor business.

Rates.—Remember every power prospect, especially if it be a large one, must be considered largely as an individual proposition. You can not make a hard and fast system of rates which will apply to all cases. Do not be afraid to go down on high-load-factor business, simply because your present cost with its low-load-factor is higher than perhaps you will be called upon to quote. I would suggest dividing your costs up into readiness-to-serve, and output expense; dividing the connected load into the total readiness-to-serve expense, and the output expense by manufactured current. This will give an indication of the value of high-load-factor business and what it can be sold for.

Off-Peak Business.—This class of business does not seem to have been given the consideration it deserves. Many stations believe it is not possible to secure any amount of this character of business. If, however, every power prospect be carefully analyzed and working hours studied, it will astonish you to find how much business can be secured on this basis. Wherever a manufacturer works two shifts it is usually possible so to arrange the hours that they will avoid your 6 o'clock overlapping peak. The proposition requires care in presenting to the manufacturer, for at first thought he will say that it is not possible, but if your man has his conditions thoroughly in mind (and he should not talk until he has) he can in many instances persuade the prospect to shorten the noon hour, start one-half hour earlier in the morning and shut down early enough during the winter months to avoid the overlap. For instance, flour mills can easily shut down during overlapping peak hours, foundries by getting out their iron somewhat earlier, and many others are in the same class. Flat rates in connection with this off-peak business work in very advantageously. I am aware of the prejudice of all central stations against flat rates and to some extent I share this for unlimited flat-rate lighting. However, I do not believe flat-rate motor business is in the same class. The manufacturer will not pay for labor or wear and tear upon machines simply to waste energy. He has a clear ly-defined number of hours to operate, a certain maximum production to obtain in these hours, and a definite number of machines to operate. A contract can thus be easily drawn which will cover the situation fairly well. The contract says nothing about the horse-power required. The company merely agrees to furnish energy in sufficient quantities to drive a certain number of carefully-described machines a certain number of hours per day. This contract is very useful in landing certain classes of men and business which could not be otherwise obtained.

Some of the results on the station curve of the off-peak business may be of interest. One plant in a city of 25,000 has now a day load of 1500 kilowatts and has upon its circuits over 90 per cent of the total power business in the city, the only exceptions being the paper mills. Another plant, in a city of 30,000 has a day load of 1000 kilowatts and is closing down plants as fast as station capacity can be installed to take care of it. Fully 50 per cent of the power contracts in both these cities contain this peak load clause.

The value to the central station of a good, heavy, long-hour motor load can not be overestimated. It furnishes a steady income for every month of the year. The amounts received per customer are relatively large and difficulties of collection very small. This power business will represent a satisfied class of customers, the most influential and best element of the city, and they will influence public opinion in your favor and largely minimize the danger of municipal ownership agitation.

Electrical Solicitor's Handbook.

The following extract from a paper by Mr. R. S. Hale, of Boston, on "The Value and Use of a Solicitor's Handbook," will be of interest to those who are already competing for the prizes as well as to others who may now contemplate to do so. The paper above referred to was presented on the commercial programme of the National Electric Light Association at Washington on June 7. "I want now to make a brief announcement of a change in plans in connection with the prize contest for the best electrical solicitors' handbook. The Co-operative Electrical Development Association wrote to all of those who had manifested an interest in the proposed contest last April to find out how they felt about an extension of time in which to submit the competing books.

"By general agreement the time was set for Oct. 1 next, and all of the competitors must have their work turned in to the Co-operative Electrical Development Association, Cleveland, Ohio, by that time.

"I am sure you all appreciate the value of this contest to central stations and others because of the stimulating of interest everywhere and a fixing of the minds of a great many agents upon the details of their own handbooks through a desire to think up some way by which they could get into this contest.

"I hold in my hands a New York draft for $2,600, which represents the total amount to be awarded in prizes to the successful competitors in this handbook contest. The money will be placed in a bank where it will draw interest until the time the awards are made in October, so that the winners will not only get their prize money, but interest on it as well."

Those interested in this subject will be furnished promptly a pamphlet giving full details and particulars upon application to the Co-operative Electrical Development Association, Cleveland, Ohio.

The Value of the Service of the Advertising Agency or Specialist.

Mr. Lawrence Manning, before the last National Electric Light Convention at Washington expressed the opinion that advertising is a vocation in itself, and that the busy manager of any business has not the time or skill to plan and carry out the details of an effective advertising campaign. The advertising agency or specialist takes in hand the situation of the central station which is very similar in general the country over and adapts an advertising campaign to the individual station needs with mere suggestions from the central-station official as to the special local conditions to be considered. The agency can produce an enormous amount of advertising matter with only a few changes or additions for local conditions at a price far below that at which it would be possible for the individual central station to produce it. The specialist turns out advertising in wholesale quantities, while the central station uses it in comparatively retail quantities. In a city in the Middle West having a population of about 150,000, there was sent to 1000 residences a systematic course of advertising matter from June to December, at which latter time two solicitors were put out on this list of 1000 residences for the purpose of determining what results the advertising had accomplished by way of having the householders wire their houses. In April these solicitors reported that 243 houses were found wired and that during the period of their work from December to April, 653 of the occupants made request for wiremen to call and give them figures. The occupants of 82 houses of the 243 found wired voluntarily stated that the wiring of their houses resulted from the advertising literature.

Commercial Results in Different Sized Cities.

Comparative results are usually interesting and stimulating. The following table, compiled from figures obtained by Mr. J. E. Montague and presented at the Washington Convention of the National Electric Light Association on "Commercial Day," June 7, will doubtless prove an interesting study to many companies, both large and small. The figures relate to the past year of operation. The paper also gives some indefinite data on other objects. In some cases there are cooking rates, usually 5 cents per kw-hour.

Population of City	Number of Customers	Increase last year per cent.	Sales cost of adding 16-cp. 50-watt, equivalent. Cents	Gross Income	Gross Income per Capita	Gross Income per kw. Station capacity	Connected load, 50-watt, 16-cp. equivalents	Rates per kw. hour. Cents		
								Lamps Flat	Motors Flat	
1,350	415	33 4	..	$11,500	$8.50	$48.00	5,000			Very Variable
5,000	567	41.05	..	31,540	6.30	78.76	.....	10	8	
15 000	872	23.7	35	64,000	4.27	80.00	30,000	10	5	Discounts
20,000	1,300	30.	37	119,000	2.98	119.00	31,215	12 to	6	
35,000	1,291	20.	..	31,953	.....	75.00	.....	.....	.....	
35,000	513	8.	..	107,590	3.07	53.80	42,000	20–10	10–1.8	Sliding Scale
80,000	3,000	20.	12	453,000	5.44	51.17	102,000	15	8	Discounts
100,000	2,412	302.	21	225,000	2.25	45.00	125,000	12–5.3	7–3.3	Discounts
278.000	6,964	18.5	21	994,339	3.57	142.05	440,775	10–	10–	Sliding Scale
300,000	6,839	47.7	39	702,744	.....	.....	380,832	10–3	10–3	Sliding Scale
1,425,000	10,192	37.5	34	2,848,822	2.00	93.63	1,167,595	12–	10–	Sliding Scale

Hartford Experiences with Electricity for Automobile Charging.

Mr. Robert W. Rollins gave some interesting experiences of the Hartford Electric Light Company on catering to electricity for automobile charging at the Washington convention of the National Electric Light Association. November, 1904, the company ordered ten mercury-vapor rectifiers for automobile charging and now has in use on its alternating-current system 44 of these equipments, which are giving excellent satisfaction. The gross receipts during 1905 for both alternating and direct-current systems for charging apparatus were $3,381.81, and in 1906 these gross receipts were $4,441.90. Of these gross earnings about $1,400 were derived from flat charge for a supply of energy, together with the maintenance of batteries for three electric vehicles, two of which belonged to the police department and the third was a bus belonging to a hotel. Contracts were made with these people to manufacture batteries complete for one-half their cost to the company and to supply charging energy and maintain the batteries at a cost of $1.75 per day for each vehicle for 365 days in the year. The scheme has proved to be profitable to the company and satisfactory to the customers. The Hartford Electric Company has a 17,000-amp.-hour battery floating on its direct-current system, for the maintenance of which and for the manufacture and up-keep of vehicle batteries, skilled battery men are employed. These batteries are manufactured under a patent owned by the Hartford Electric Light Company. Pure lead is bought in the form of lead wire 3/8-in. in diameter, cut into the proper lengths. These

lead strips are passed through a die which gives the desired surface. The parts are then burned together, forming the plates, after which the plates are electrochemically formed. Approximately 75 electric vehicles are in use in the streets of Hartford. The average cost of energy for 17 pleasure runabouts for 1906 was $3.19 per month, among these customers being several doctors, who wish their vehicles ready for service at all times. This year the call for charging equipment very materially exceeds the record for the past two years, and Mr. Rollins feels confident that automobile charging will in the near future become quite a prominent factor in central station power business.

Determining Results from Advertising.

Mr. E. S. Marlow, in a paper presented on Commercial Day at the National Electric Light Association Convention at Washington, put in a very sound and sensible plea for a systematized effort on the part of central-station companies to keep track of the results obtained from advertising. He states that, of course, there are some forms of advertising from which it is practically impossible to trace direct results, such as newspaper, billboard and street-car advertising; but as the majority of the companies which advertise make use of the direct-by-mail method, it seems that at least a part of the results can be traced which would help the advertising manager to judge the best pieces. His experience in trying to get information on this subject from member companies as well as that of a reporter to the Association of Edison Illuminating Companies in 1906, shows that central-station companies are not keeping such records as well as they should. Hit or miss methods can only be eliminated when the various companies have applied themselves to the work of keeping account of the direct replies to each piece of advertising sent out, the contracts closed as a result, the value of the business thus received and the net expense of securing it.

The New York City Ordinance Taxing Electric Signs.

By Carmelita Beckwith.

On May 7, 1907, Mayor McClellan approved an ordinance adopted by the Board of Aldermen, "regulating the placing of electric signs in the City of New York and providing that the same shall be licensed."

The ordinance adopted, a very important one in many respects, is worthy of being quoted in full, as follows:

Section 1. Any electric letter, word, model, sign, device or representation in the nature of an advertisement, announcement or direction erected at right angles to any building shall be deemed to be an electric sign.

Section 2. Electric signs may be hung or attached at right angles to buildings, and extend not to exceed six ft. therefrom in said space, and to be ten ft. in the clear above the level of the sidewalk in front of such building, upon the payment of an annual license fee of 10 cents for each square foot of sign space or part of square foot of such sign space, to be collected by the City Clerk of the City of New York. The square feet of sign space on one side of an electric sign, however, shall be deemed to be the entire number of square feet of sign space for the purpose of computing the license fee herein referred to and required to be paid. All electric signs shall be constructed entirely of metal, including the uprights, supports and braces for the same, properly and firmly attached to the building, and shall be so constructed as not to be or become dangerous. Before any permit is issued by the City Clerk, plans and statements of the proposed sign and method of attachment to the building must be filed with the Superintendent of Buildings having jurisdiction, as provided in Part 2, Section 4, of the Building Code, and his certificate of approval be obtained as to the sufficiency of the construction and method of attachment to the building. A certificate must also be obtained from the Department of Water Supply, Gas and Electricity certifying that the proposed electric wiring and electric appliances are in conformity with the rules and regulations of that Department.

Section 3. No certificate shall be given by the Superintendent of Buildings, and no permit shall be issued by the City Clerk, for the erection of electric sign or signs on any building when such building adjoins a building occupied exclusively as a private residence unless the written consent of the owner or owners of said private residence for the erection of such electric sign be first obtained.

Section 4. No electric sign shall be placed, hung or maintained, except as in this ordinance provided, under a penalty of ten dollars for each offense, and a further penalty of ten dollars for each day or part of a day the same shall continue.

Section 5. All ordinances or parts of ordinances inconsistent or conflicting with the provisions of this ordinance are hereby repealed.

Section 6. This ordinance shall take effect immediately.

This ordinance has been welcomed by the several lighting companies of Greater New York, for at last the electric sign is recognized and established in the eyes of the law. For some time past signs have been erected under the old ordinance which allowed a projection of but three feet. Almost all of the signs in place have overstepped this limit. It was necessary, for what does three feet mean in this connection? Any one with half an eye for distance can see that not one sign in a hundred met these requirements. The companies have been treading lightly, not knowing exactly what was proper and law abiding practice. This ordinance now settles the matter in the opinion of the companies and they are going ahead under its provisions.

"While at first sight the new ordinance looked as though it might be objected to by the central stations," said Mr. M. S. Seelman, Jr., of the Brooklyn Edison Company, "since it has been enacted we are pleased, inasmuch as it gives the electric sign a legal standing. Heretofore we have been putting up signs and taking chances; if the Bureau of Encumbrances chose to object, it could do so and we were helpless. This ordinance for the first time gives the electric sign a legal right to exist up to within six feet from the building line, so that signs conforming to this requirement will not be a source of trouble in any way. Of course, the adoption of the ordinance means a tax of between $1,500 and $2,000 a year to this company, but we are willing to pay the sum to secure for the electric sign a sure standing in court.

"This company welcomed the act and there would have been no trouble in connection with it were it not for the last clause which stated that the ordinance would go into effect immediately. The Police Department instantly notified our customers that unless they complied with the requirements of the law inside of 24 hours they would be fined $10 a day. You can imagine the result. We were besieged, by telephone, messengers and personal calls.

"Mr. W. T. Fairvain, the company's general inspector, immediately communicated with the City Clerk, whose duty it is to collect the tax under the ordinance, and Commissioner Bingham, arranging a conference at which it was decided that the enforcement would be postponed until the first of August. This makes the change possible for our company, for we now have 30-odd days in which to get a list of these signs, have them measured and send checks to each of our consumers covering his tax.

"The method of making application for permission to hang a sign has become greatly complicated by this new act. To begin with, an application in triplicate must be signed by the owner of the building on which the sign is to be placed and by the tenant desiring the sign; the signatures must be witnessed by a notary. This triplicate application is then taken to the Building Department with a sketch of the method of construction and attachment. It is next taken to the Department of Water Supply, Gas and Electricity to be passed upon for the proposed wiring equipment of the sign. With the approval of these two departments application is made to the City Clerk who is the final arbiter."

Mr. Seelman said in conclusion: "Naturally this complexity involves an interminable amount of work in connection with merely one feature of our business, and therefore we are making every effort in Brooklyn to simplify the process. However, so far there has been little difficulty, as we have nowhere run counter to any disposition to insist on technicalities, and we believe that it is only a matter of experience and development when these trying details will be eliminated."

In talking about the new law, Mr. Arthur Williams, of the New York Edison Company, said: "Nowhere else in the world is there such an effect as the electric signs present in the Borough of Manhattan, on Broadway south of Forty-Second Street and on Forty-Second Street itself, east and west of Broadway. While this is the largest center it is only one of the many brilliant displays. These electric signs are the talk of the whole world. Investigating committees of civic bodies have been referred here, not only from our own country but from abroad, and the whole display is regarded as a permanent exhibition. It brings visitors to the city, brings them out when they are here, and when they are out, they buy. Anything that increases trade brings prosperity; increased rents raises the value of real estate; this all should mean increased taxes, and the Board of Aldermen have acted wisely in passing the new law, allowing the electric signs to project six feet from the face of the building, and at the same time levying a small tax to be paid either by the supplying company or the consumer. The present law limits the size of the signs somewhat more than many persons think is proper; but while the City Fathers appreciate the desire of the public they are ever mindful of the best interests of the city, and we are sure they do not intend to put any needless burden on the people or the public."

The United Electric Light & Power Company immediately reprinted the new ordinance in a neat little folder, and distributed it among its consumers, that they might be advised, at the same time stating that the company would pay the tax on these signs, which amounts to about $500, distributed in various parts of the city.

Mr. Frank W. Smith, secretary of the company, said that the new ordinance would make a material difference in its sign business, as it has put it in a position to comply with the law in furnishing and erecting free signs. Said Mr. Smith: "This new ordinance really legalizes what heretofore has been done in violation of the existing law, which never met the requirements. We shall go right ahead and where the company maintains and provides signs, necessary permits will be obtained and the license paid. We were very active in our co-operation with the City Departments in connection with the new law and are applying for permits for all the signs we now have installed. A pamphlet containing the ordinance is being freely distributed among contractors and builders, that they may also be familiar with the new requirements."

The general consensus of opinion is that while this new ordinance makes it necessary to pay an annual fee on the signs, it really legalizes electric sign work and allows the consumer to get the benefit of all of the requirements of the law, which heretofore has not been the case.

Publicity: or, How I Bought a 5-hp Motor.

We reprint the following amusing criticism of present-day publicity methods from our London contemporary, the *Electrical Review*. The writer avers that it is based on facts.

I was in want of a 5-hp motor for driving a small machine, and sent the following inquiry to a large Americanized motor manufacturing company: "Kindly quote me, by return post if possible, for a 5-hp shunt-wound motor, to run at about 1200 r. p. m. on a 200-volt continuous current circuit, complete with sliding rails and pulley."

In reply to the above I received the following: "We are much obliged by receipt of your valued inquiry for motors, and enclose you herewith our Motor Enquiry Form, and on receipt of this duly filled in we shall be able to quote you by return of post."

This form was one of the new publicity documents, and contained about 125 columns or spaces to be filled in with various particulars, and covered every conceivable detail that might apply to a motor of any description, continuous or polyphase. I thought it best to fill this form in, although I could give no more information than was contained in my original inquiry.

By return of post I received the following:

"We are duly in receipt of yours of yesterday enclosing our Motor Enquiry Form filled in, which we have handed over to our Estimating Department, who will quote you in due course. As you are in the market for motors, we enclose you herewith our pamphlet on Motor Driving, which will show the absolutely unique position we hold in the motor world. There is no branch of this extensive industry which we have not touched, and the services of our vast technical staff are fully and freely at your entire disposal. Awaiting your further inquiries, we are, etc."

After waiting two days, I sent a post card to remind the firm that I had not received the quotation yet, and received the following reply:

"Your postcard came duly to hand, and we regret that, owing to extreme pressure of business in our Estimating Department, your inquiry has not yet reached its turn. We receive thousands of inquiries daily for motors, and these must, of course, be taken seriatim. We are now within a few hundred of yours, and have every hope of reaching it to-day. We take the liberty of enclosing herewith our pamphlet on Electric Ventilation. We know that 99 per cent or more of the offices in London would be equipped with our electric fans if we had the chance of personally discussing the matter with the tenants, and if, after perusing the enclosed, you would like a call from us, we will send round one of our salesmen who will go fully into the matter with you, and positively convince you that it is physically impossible for you to successfully carry on your business without one of our electric fans on your desk."

Then, after a day or two, I sent another postcard, saying "Do please let me have that quotation by return." But instead of the estimate I got the following:

"We regret that our quotation has not reached you, but the whole of our engineering staff have been working night and day on it, and hope to have it completed by midnight to-night, and it shall be sent round by special messenger in the morning. We find that we have not yet heard from you on the subject of electric fans. We have tried our best to make the advantages clear to you, and to show you how much more life would be worth living during the hot weather, if your office could be kept cool and fresh by electric fans. If we had the descriptive powers of Sir Walter Scott and the force of Sandow, we might succeed in making the thing stronger, but being simply salesmen with nothing but our knowledge of the real beauty of fans to tired, overheated humanity, we can only repeat that it is our firm conviction that you cannot possibly be happy until you get them."

By the same post I received also an appeal from the supply company, who had evidently been told by the motor company that they had had inquiries from me for motors, and that in all probability I had a private plant. The circular was to the following effect:

"Why make your door a dump-heap? Customers will not push into your office past dusty, greasy stokers; and coal and ash carts on your curbstone do not look well. Let us do the shovelling. Let us make the noise, grease, smells and dirt, miles away from your office. That is our business; yours is to keep clean, cool and quiet. We are experts in the shovelling business. Our men like it. It is second nature to them. On receipt of the enclosed card, one of our salesmen will be round by motor-car in five minutes."

Another postcard from me to the motor company, saying that unless I got the quotation by return I should go elsewhere for my motor, brought forth the following reply:

"We know how tired you must be waiting for that quotation,

but we can assure you that when you get it you will be delighted. No motors are like our motors. Every horse-power given by our motors is worth at least five horse-power given by any one else's. What about arc lamps? Surely you want some arc lamps, and we enclose herewith our bulletin which tells you all about them. Electric light is one of the great discoveries that go far towards making this twentieth century life of ours better worth living—fuller of refinement, comfort and culture."

Just as I had finished reading this, my clerk brought in a traveler's card. He represented a motor maker. I don't usually see travelers, but just as a drowning man clutches at a straw, so I grasped the chance of seeing this man.

"Do you make motors?" I asked. "Well, then, can you give me a quotation for a 5-hp, shunt-wound motor, 200 volts, 1200 r. p. m.?"

"Oh, yes," he said. "I can give you a quotation for that now." And in about two minutes he had figured it out from his list, and taken off the discount.

"Now, then, how soon can you deliver?"

The traveler turned up his stock list, and said, "We have one in stock—could send it off to-day if I wire the works."

"You are not an engineer, I suppose, just a traveler, and know nothing about the technical details of these motors. Don't know a motor from a rheostat, I suppose?"

"Oh, yes," he said, smiling, " I am an engineer, and can tell you anything you like about the motor."

The result was that this representative took the order with him, telegraphed for the motor, and it was in my place and running within two days.

I am still receiving weird pamphlets and bulletins from the motor company, and I suppose their engineering staff are still working night and day on that quotation, for I have never received it.

Commercial Methods of Exploiting Heating Appliances.

Mr. T. K. Jackson, general manager of the Mobile Electric Company, presented a paper on Commercial Day at the Washington convention of the National Electric Light Association on "Commercial Methods of Exploiting Heating Appliances," telling of the work done at Mobile. The Mobile Electric Company begain in August, 1906, a campaign for the introduction of electric irons. This campaign was started by extensive news paper advertising for the first 30 days, making a 30-day free trial offer. This was followed up by house to house canvassers, who left electric irons wherever possible, with the request that they be tried. The only thing required from the customer when the iron was left was a receipt which called for the payment of $4 at the end of 30 days or the return of the iron. Conjointly with this the literature of a well-known advertising company was sent out very freely. Between August, 1906, and April 30, 1907, 640 electric irons had been accepted and paid for. At no time was there more than one man engaged in this work, and only for a period of 30 days was his time exclusively devoted to canvassing for electric irons. This man, or boy, rather, received $45 per month. During the time he was putting out irons he placed on an average 20 irons per day. Of these irons 805 were accepted. The rest were returned, burnished up and redelivered. While the percentage of irons accepted originally by the consumers at whose premises the irons were left averaged about 80, the real average of the ultimate users of these irons was higher, as in many instances irons were returned and subsequently the same people called at the office and purchased new irons.

One laundry in the city, operated entirely by electricity, uses 35 irons and electrically heats the rolls on the larger machines. Another laundry uses 18 irons. To introduce the iron to these laundries the company took its chances on the success of the installation, bought the irons, and did the wiring subject to a 60 days' trial and approval. In one of these laundries a rate of 2.75 cents per kw-hour was made and in the other 3 cents. These rates made the cost of electric ironing, as compared with heating the irons by gas, about three times as great as the cost of gas, but the owners of the laundries say that four of their girls can turn out as much work with electric irons as five could turn out with the irons heated by gas or other methods. It therefore pays them to use the electric irons. Aside from this, it was found that there were fewer garments scorched or under-ironed with electric irons than with others. For this class of work a very much higher grade of solicitor is required than for residences. One of the company's show-windows was decorated to represent a high-class dining room. On the dining-room table was placed an ironing board, and inside a girl was kept for a time with a white gown, ironing with an electric iron. A placard was placed in the window with this statement: "She does not have to wear her old clothes to do her ironing."

The company's contract department consists of three men, besides the man at the contract window—one man on power, one man on store illumination and signs, and one man on residence lighting and electric irons. The power department has contracted on an average for 185 horse-power per month since its organization. The sign department has increased flat-rate sign business $7,200 per year since Jan. 1, 1907. The number of contracts written from Jan. 1, 1907, to April 1, 1907, was 650 in the face of an increase in lighting rates. The population of Mobile is between 60,000 and 70,000.

Sizing Up the Territory.

Mr. George Williams, of Cincinnati, in a brief paper presented at the Washington convention of the National Electric Light Association gave some good advice, based on extensive experience in sizing up solicitors' territories and preparing lists of possible customers from which to work. His suggestions are as follows:

The solicitor's district is ordinarily found to contain a variety of prospects that call into use nearly all standard electrical appliances and types of lighting. If the population of the territory is exclusively resident and numbers over 10,000, the district will be of a high character of dwellings and will offer many possibilities of power and electrical appliances that would not find so ready a sale in districts composed of poorer dwellings. The latter district will contain a greater variety of possibilities because of the intermingling of stores, saloons and factories. While some districts will unavoidably produce greater revenue than others, any district can be cultivated at a profit regardless of the character of its population, class of dwellings, or nature of the commerce.

The necessity of knowing who and what it is desired to sell, in advance of the attempt, is quite apparent in the sale of anything and especially true in the sale of energy. The process alone of compiling the list of prospective customers will warrant the work entailed. The actual number of possibilities for various appliances and forms of lighting far exceeds the number usually closed, and we are all inclined to underestimate this or the increasing number caused by growth of population and growth of possibilities through education, so that a frequent analysis of the possibilities is advantageous, if only used to decide the plan of campaign or the provision for supply.

In an undeveloped district a hit-or-miss method may result in success, but with the progress of a campaign the importance grows for listing the possibilities systematically. As no example exists of completely developed sales, the proportion of sale to possibilities can not be precisely estimated, but there is sufficient proof that geographical location or size of city does not prevent development of sales. Likewise in the solicitor's district wherever light and power are already applied by less convenient agencies, or new uses created, it is simply a matter of locating the prospect and conveying the information of the merits of the electrical method.

The rapid improvement in electrical appliances has made electric energy an easy commodity to sell and has mutiplied the

prospects for sale. The retailer now has ample precedent regarding the merits of electrical advertising, and the resident demands an illumination for comfort rather than bare necessity for safety.

A few years ago the name and address of house occupants might suffice for a list of prospects; now a list of a score of items can be recorded to one household and all worked on to advantage, because electricity has been applied with efficiency at a more rapid rate than the central station has educated its public.

We are apt also to underestimate the purchasing ability of the prospect. It should be remembered that in the majority of instances the same amount of money, or greater, is already being expended by the prospect for the same object, while nearly every difference is in favor of electricity.

If every customer possessed the knowledge of the merits and possibilities of the accomplishments by electrical application, there would be little need of solicitation or advertising; hence the importance of classifying the possibilities and promoting the intelligence in the most economical manner.

For canvassing a district, the form of a directory listed in the order of streets and house numbers, allowing for indication of equipment or possibilities of sale, is perhaps the most convenient. This book is especially valuable to acquaint the solicitor with the name and equipment, avoids uselessly questioning the prospect, and forearms him with useful information before interview. The book may be maintained by checking with office records, observance of changes of residence, and routine canvass.

A card index or tabulated list of prospects, classified by the nature of the business or class of articles for which they are desirable prospects, is a simple record for mailing lists or for solicitation by special talent.

Methods of Securing Residential Business.

A paper on this subject, by Mr. R. C. Hemphill, Jr., of Ann Arbor, Mich., was among those on the programme of the National Electric Light Association at its Washington convention, June 4 to 7. The paper relates to policies adopted in residence districts in cities with a population of from 5000 to 20,000. Selecting from the employees two or more good-looking, bright-witted chaps, a canvass is started to obtain information on the following items from each house: Number of rooms, occupant, owner, kind of service used, if customers, have they an iron, wired or piped, kind of fixtures, remarks as regards prospects. From the field book in which these notes are taken a card index is started in the office. The line of talk these preliminary canvassers are trained to give during this canvass is as follows: "I am the representative of the electric company. Do you have our service?" "No, we use gas." "Can I not interest you? A number of your neighbors are using our service. Our rates have been materially reduced and the management thought that this spring you would be interested in having us explain its advantages."

If he finds the house is connected, the talk runs something like this: "I am a representative of the electric company and called to see if our service is entirely satisfactory, and if there is anything we can do for you. The management wants your co-operation in giving good service, and if you can suggest anything along that line we will be glad to hear of it."

It is certainly astonishing what a pleasant feeling is at once established between the company and the consumer, indirectly paying more than the entire cost of the canvass.

We are now ready to begin work. A certain street is selected and the cards are examined. You decide to send your men after all dwellings not wired. A list is readily made and the replies brought in are added to each card. Different lists are made up in different districts of houses wired, but not connected; wired, but no fixtures; kerosene-lamp houses (a greater proportion in each town than most people realize); a list of houses using gas, and a great list of houses using combinations of all systems.

This is the regular grind of the soliciting department in the residential districts. We have also a scouting or special department consisting of one man who looks out for new houses, extensive repairs being made on houses, and inquiries from our direct-by-mail advertising. He gets his ammunition from building permits, contractors and newspaper clippings. The rest of each day he puts in, during this time of the year, on irons, and a little later on fan motors; in the fall, on porch lights, and so forth. Small cards are printed for him on the addressograph and these are arranged according to street numbers. He sorts out those that are supplied and goes out after the others.

ADVERTISING.

We carry on various advertising campaigns, trying to supplement the work of our canvassers.

Newspaper Advertising.—We carry a double-column 5-in. space with each daily paper, changing the advertisement every week.

Direct-by-Mail Advertising.—We mail to 50 per cent of our residences monthly bulletins. We get good results not only by pleasing our present customers, but also in getting others to discussing various appliances.

Exhibition Room.—We have in connection with our office a large display window and exhibition room, kept attractive by frequent changes. We endeavor each month to adopt a special feature, as for instance, in January, small-cp and Hylo lamps; February, motors; March, fixtures; April, irons; May, cooking and heating appliances; June, fans, and so on during the year. We endeavor to have on exhibition and in operation every article mentioned in our advertising or spoken of by our canvassers.

We endeavor during April of each year to give a week's practical demonstration of heating and cooking devices. In conducting a demonstration the chief aim should be to give it tone. The class of people you want to attend is not the class that goes to free exhibitions, and the class that goes to free exhibitions is not the class you want.

You first engage your demonstrators. It is better to have two and on their arrival lodge them in the leading hotel and have an interview or local notice in all the papers. Secure a hall that will seat about 200, if possible connected with some church or society. Build a small booth in the center of the room and arrange the chairs around the booth. On the sides of the room have in operation every device that you can get your hands on. Trim the room and booth with flags, bunting and flowers.

First, great care should be exercised in the invitation lists. The invitations themselves should be in good taste, with no advertising features whatever, but entirely complimentary on the part of the electric company. Care should be exercised that the ladies of the same neighborhood should receive invitations for the same afternoon. Having two demonstrators, two meetings can be held each day, one at two in the afternoon and one at eight in the evening. The meetings take two hours or two hours and a half and begin with a short talk by one of the demonstrators or by the manager of the company. We interest the teachers in the manual training schools, and they very kindly assign sets of four girls for each meeting, who serve the guests; thus at each meeting four different families become interested in electric cooking. After the *menu* has been served the guests are invited to inspect the various articles on exhibition around the room. The manager, superintendent and solicitors should be in daily attendance, and one of them receives the guests while the others should be ready to answer all sorts of questions. No effort should be made to sell articles on exhibition. Eliminate the business feature as much as possible and make it a purely and strictly complimentary social function.

This is the outline of the campaign we are carrying on for new business. We propose to spend 3 per cent of our gross income on this department. We are getting satisfactory results.

Increases of gross incomes are from 18 to 30 per cent, and in the case of one town of 8000 people, 38 per cent. In every prosperous American city the electric business can be increased 25 per cent or more by a systematic effort; or, in other words, the electric business can be doubled every four years.

Part of the Great White Way.

In a recent issue we published an illustration of the "Gold Seal" electric sign, erected on the roof of Engel's Chop House at Herald Square, New York, indicating a new departure in sign work. As several new stories are to be added to the old building the sign had to be removed. Our picture was made as the framework was being taken apart, preparatory to storing it for the summer. Some idea of the size of the sign may be had, as the 15 men at work on it appear as midgets. The group shows the sign at night and its location on Herald Square, in the very heart of New York's "Great White Way." So many highly effective signs have recently been made by the O. J. Gude Company, and put in place, that to-day this one which occasioned so much favorable comment when erected, will hardly be missed.

Immense Electric Sign Removed from New York's "Great White Way."

A Public Service Corporation's Statement as to Business Methods and Public Policy.

The Brooklyn Edison Company has printed as an advertisement the following statement of its policy as relates to the public:

The Edison Electric Illuminating Company of Brooklyn believes and acts upon the theory that any permanently satisfactory business must be built upon the basis of mutual advantage, and that this mutual advantage consists in giving the public the best service possible at a price consistent with the maintenance of such service, and a reasonable profit to stockholders upon their investment.

The company's securities represent capital actually invested in the business. The company's rates are so arranged as, with careful and economical administration, and the maintenance of a high and even liberal standard of public service, to permit of the payment of a reasonable return on this investment.

These rates differ in accordance with quantitative consumption as governed by minimum guarantees on the part of the customer, and in accordance with certain broad divisions of application, as being, for instance, lower for power energy than for lighting energy, but there are no secret rates and no discrimination as between customers in the matter of rates, all rates being public and the same rate being charged in every case for similar service under similar conditions.

These facts being as stated, this company believes itself entitled to the good will and confidence of the Brooklyn public.

Letters to the Editors.

Motors for Household Uses.

To the Editors of Electrical World:

Sirs:—We noted with interest the editorial suggestion in a recent number of the Electrical World that it is now time to devise methods whereby one motor may be used for several household purposes. This is interesting as illustrating one line in which electricity has not made the advance that was predicted in its earlier history. Some 15 years ago the writer prepared an article discussing the generation and application of electricity for farm use. In this, attention was called to the fact that while the farmer had his many horse-propelled labor-saving machines, electricity afforded the housewife an easily adaptable power for saving labor in several directions.

It was contended that with some little forethought the kitchen, laundry, dairy, sewing-room and possibly a little workshop could be so located or in some respects combined, that a comparatively short shaft running in graphite bearings, driven by a motor of not to exceed one-half horse-power could be installed in an inconspicuous location, but from which power could be conveniently taken for the operation of washing machine, ironing rolls, meat chopper, dish washer, bread kneader, sewing machine, fan, pump, churn, milk separater, butter working table, etc. In the country one room is often used to serve two or three purposes. The kitchen often serves as laundry, and the dairy contains the pump, and possibly some shop tools, and the sewing room could be located just on the other side of the partition from the kitchen, so that all the power-driven appliances could be closely grouped. It would seem that with some planning similar results could be secured in a city home.

The furnace and laundry being located in the basement would indicate the placing of the mechanical transmission in the basement, with control of the motor and appliances from both basement and first floor. For this purpose magnetic clutches, if properly worked out, would be especially desirable. Several should be provided, allowing the motor to operate on a ventilating fan without operating the shafting. From the line of shafting it would be comparatively easy to make connection to a couple of points in the kitchen and one or two in the sewing room, if such were located on the first floor. If, however, the sewing room and dressing rooms were on the second or third floor, it would be a more difficult matter and the use of one or two extra motors of very small size would doubtless be preferable to mechanical transmission for that distance. Here again, if desired, combination could still be effected to some extent by so designing the motors that one end of the shaft should operate a fan with deflector and the other end some mechanical appliance, both being attached to the shaft by suitable clutches.

Each house equipped will require different arrangements to secure desirable results. No standard outfit can be devised suitable for selling as an article of supply, that will cover all requirements. A combined laundry and kitchen equipment with pump attachment would be practicable. The various appliances would be attachable to a framework to be bolted to the side of the room and supporting the motor and mechanical transmission. The more cumbersome appliance would be removable when not in use.

Fifteen years ago we had expected these problems to be largely solved within four or five years, and electricity to become the household drudge. Development, however, has been along other lines, of which switchboard construction may be mentioned as a conspicuous example.

In the article referred to, which was followed in a short time by a series of articles in the ELECTRICAL WORLD by Mr. Black along much the same line, it was suggested that a fairly cheap source of power for generating the current needed could be secured through use of farm animals shut into a stall upon an inclined rolling floor which should operate a small generator with speed control. With recent advances in the use of gasoline and alcohol engines this appears a very crude source of power, but it promised to be more reliable than wind power or water power secured from country rivulets.

It would now seem that for such locations a small internal combustion alcohol engine would offer the most practical solution. This would be used to drive the small main shaft direct when needed, and through a clutch to drive a very small generator for supplying fans or lamps. It would seem that we are warranted in looking for considerable development along this line in the near future. The company that first puts out a compact, practical outfit of this kind at a reasonable price will lay the foundation of a large and growing business, this field so far as we know not being now worked to any extent.

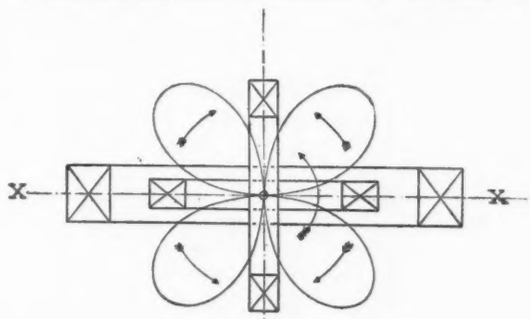
TOLEDO, OHIO. R. R. MILLER.

The Synchronoscope.

To the Editors of Electrical World:

SIRS:—In your first issue of May, 1907, you publish an article by Mr. D. H. Cohen on the "Synchronoscope." I would like to call your attention to what seems to be an error in the discussion of this instrument given by Mr. Cohen.

Referring to Fig. 1 of his article, he states that the rotating field south pole on the right will be drawn toward the north pole of the pulsating field, as indicated by the small arrow.



THE SYNCHRONOSCOPE.

Evidently this is incorrect as the two fields will tend to become parallel with similar poles in the same direction.

If the large arrow showing the direction of the rotating field be reversed, then the direction of the impulse as shown by the small arrows will be correct. In discussing the relation of the fields, he states further as follows:

"It is thus evident that under all conditions the armature will so place itself that its flux will coincide with that of the field south to north pole at the instant when the latter is at its maximum value." This is correct as it stands, but taken in connection with Fig. 1 it may be interpreted to mean just the opposite of its true meaning. The whole matter is made clear by stating that the two fields tend to become parallel with like poles in the same direction.

ITHACA, N. Y. S. R. DODDS.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Series-Shunt Motor.—A description of a compensated single-phase commutator motor of the Felten & Guilleaume-Lahmeyer Company. The motor is a compensated series motor and has two sets of commutator brushes. "It has a primary stator winding the magnetic axle of which coincides with the direction of the short-circuited power brushes. In quadrature with these are the excitation brushes which are connected in series with the stator winding, and simultaneously in parallel with the network by means of a shunt transformer. The excitation brushes are, therefore, connected in a double way to the network and for this reason the new motor is called a series-shunt motor (Doppelschluss motor)." The special feature of this motor is its high starting torque; with double the normal current it developes up to about 4.5 times the normal torque.—*Elek. Kraft. u. Bahnen*, May 24.

Turbo-Alternators.—An illustrated description of the pair of 2000-kw, three-phase turbo-alternators for the municipal station of Sydney.—Lond. *Elec. Eng'ing*, June 6.

Hjorth.—An article, illustrated by diagrams, giving historical notes on Sören Hjorth, a Dane, who is the original inventor of machines embodying the dynamo-electric principle and who in 1851 filed a provisional specification for a machine embodying this feature.—Lond. *Elec. Eng'ing*, June 6.

Lamps and Lighting.

Nernst Lamps Versus Gas Incandescent Lamps.—An article stating that the Fulham Borough Council is advised by its electricity committee to adopt Nernst lamps in preference to incandescent gas lamps for those streets in which electric cables are already laid. Tests were made which were attended to by gas companies' representatives with their instruments. The details of the tests are given in a table.—Lond. *Elec. Eng'ing*, June 6.

Power.

Development of Large Power Stations.—T. C. McBride.—His presidential address before the Engineers' Club of Philadelphia on recent developments in large electric power plants using coal as fuel and supplying lighting and traction systems. The author gives an outline of the gradual development of large high-tension alternating-current distribution systems with substations, and the gradual rise in the transmission voltage. Storage batteries are rapidly assuming an important place in the organization of large power plants, and it is said that the usefulness of the storage battery has been much increased, particularly during the last year, by a great increase in the possible discharge rate for short periods. The author thinks it likely that the near future will see the storage battery applied to alternating-current plants, since for single-phase railways it may be advisable to supply distant stations with batteries and rotaries which will run inverted and also possibly with automatic boosters. The development of large steam engines is then traced and some data are given on the design of steam engines of 7500 horse-power at their best efficiency which are thought to represent the final development in size of the steam engine for electrical power-house work. The great progress made in steam turbines is then described and the development, together with the steam turbine, of the use in the United States of the superheater and of a special form of condenser for high vacuum. The large gas engine has not made any impression on strictly central station practice in the United States, but is now making rapid progress in steel works, and from the advantages it has to offer to central stations its extensive adoption by them in the near future seems assured. The author makes a comparison between the cost of installation and the cost of operation of a 16,000-hp plant using either steam turbines or gas engines. The load factor is assumed to be 60 per cent. The cost of installation per kilowatt of nominal rating of a gas plant consisting of four 4000-hp gas engines, four gas producers and four 3000-kw generators, with accessories, etc., is given as $90.98. The results of the comparison of cost of operation are given in the following table. As no charge is made against the gas engine plant for the cooling water, the steam turbine plant is charged with only its make-up water.

	Cents per kw. Hour. Turbine.	Gas Engine.
Coal (reduced to $2.50 basis)	.313	.166
Water	.008	....
Labor	.064	.043
Oil and waste	.003	.007
	.388	.216
Maintenance, boiler room	.017	....
Maintenance, turbine room	.007	....
Gas engine and producer maintenance assumed same as above	....	.024
Add 2 per cent to cover cost of driving the gas-engine auxiliaries	....	.005
	.412	.245

The author then figures that even looked at in its most disadvantageous light the gas-engine plant in capitalized saving in operating expenses has a very considerable advantage over the steam plant in first cost. In the discussion, C. E. Lucke thought that the figures of cost for the first installation of the gas-engine plant and for its operation given in the paper are far too low, and that each cost should be increased by 50 per cent. He thinks the question whether it is advisable to use the gas engine instead of the steam engine depends on local conditions and especially on two factors, the cost of coal per ton and the load factor. When coal is expensive and the load factor is high, it will be advisable to use gas engines, and they will earn good dividends on the increased first cost over a steam station. H. P. Childs gave some facts on the very successful operation of gas-engine driven alternators in parallel, with frequencies of 25 and 60. One of the independent operating companies at Hazleton, Pa., has a culm pile consisting of about 2,000,000 tons that has been stored up for a great many years. It does not pay them to ship this coal, so recently a plant has been installed to generate electricity directly at the mines. While this is merely a beginning, the expectation is to put in a large plant, and from careful engineering figures, the investment will pay handsome dividends. There is a large market for energy within 30 miles of Hazleton, and while there is no market for the culm, the culm is being charged to the plant at 50 cents per ton, so it enables the mining property to realize on what was heretofore practically a waste product and also to make money on the electric plant. C. Hering referred to the freight charges for coal on railroads. If it is a fact that the cost of transportation of coal is about two-thirds of the whole cost to the consumer, then the efficiency of this kind of transmission is 33⅓ per cent, which is poor compared with the efficiency of electric transmission from a power plant located at the mines to distant cities. Moreover, the cost of the railroad with all its equipment is much greater than the cost of the electric plant to transport all of that energy in the form of electrical energy rather than to transport the coal on freight cars. In other words, the carrying of coal on freight cars is certainly a very poor and antiquated system at the present day, and it is surprising that it has continued to exist so long. Concerning the Thury direct-current high-tension system, he thinks that its chief sphere is in connection with a river that has a series of cataracts some distance apart. A central station can then be erected on each large fall, and all connected in series together. E. G. Perrot brought up the question of electric power transmission from a power plant located in the Pennsylvania mining district, say, at Hazleton or Wilkes-Barre. Heat is needed in winter time and the question is whether the cost of heating houses by electricity generated at the mines would be any more than if the heat were generated in stoves or heaters. H. K. Myers replied that "figuring on the cost of fuel for gas producers with the idea of getting down to about 1 lb. per kw-hour would mean 2000 kw-hours from a net ton of coal; based on a 10 per cent loss with the transmission line would mean a charge of $2 per ton to get that fuel to its destination based on energy at 1 cent per kw-hour, while coal is now being shipped to Philadelphia at a much less price. Energy is produced in Philadelphia, after paying freight on coal, cheaper than it would be if it were transported over transmission lines from the mining centers." J. Christie stated that the records of cost of electric energy at the Pencoyd and Ambridge plants of the American Bridge Company show six-tenths of a cent per kw-hour. The fuel cost is less at Ambridge than at Pencoyd, but other expenses are greater, and the totals average alike at both places. This cost is made up of prices paid for all material and labor, etc., and to these is added 10 per cent per annum of the entire cost of the generating plant and the distributing lines, but it does not include the losses in the lines; that is, it is the cost of energy delivered at the switchboard. When to this cost is added the pro rata of all the general distribution charges of the works, the entire cost of energy is very close to nine-tenths of a cent per kw-hour. These figures represent the costs for direct-current electric stations of not less than 1000 kilowatts. In his reply, T. C. McBride said that his estimate of first cost is based on actual selling prices of manufacturers. If Prof. Lucke thinks that the plant would cost twice as much, his estimate is probably based on the consideration of smaller sized units than have been selected in the example given.—*Proc. Engineers' Club of Phila.*, April.

Power Plant in Colorado.—P. Affolter.—An illustrated description of the new power station of the Northern Colorado Power Company. It will be steam driven, coal being obtained from two mines near the plant. The first steam-turbo-genera-

tor installation consists of two 2000-kw units, to supply power for about 15 towns in northern Colorado, which are to be served by the company. The generators are six-pole, three-phase, 60-cycle machines, delta-connected. They are rated at 2000 kilowatts at 13,200 volts and 1200 r. p. m. and guaranteed to carry 50 per cent overload continuously without injury. Two 1000 kilowatt units of the same general type as the 2000 kilowatts units are later to be installed to care for the electrification of the Colorado & Southern Railway. The generators will be 1000-kw, 11,000-volt, 25-cycle, one-phase machines. The power will be distributed by two high-tension plants at a voltage of 13,200 and 44,000 respectively and by several 2400-volt lines. There will be seven sub-stations.—*Jour. of Eng'ing*, University of Colorado, No. 3, 1906-7.

Power Station.—An illustrated description of the new power station of the Great Eastern Railway Company at Stratford for the supply of their local power and lighting requirements. The station is a good example of modern cheap construction. Steam turbines are used.—Lond. *Elec. Eng'ing*, June 6.

Charging Apparatus.—G. MEYER.—The first part of an illustrated description of new electrically-operated charging apparatus for blast furnaces.—*Elek. Kraft. u. Bahnen*, May 14 and 24.

Internal Combustion Motors.—BOCHET.—A paper read before the Society of Electricians in Paris on the various types and the advantages of internal combustion motors.—*L'Ind. Elec.*, May 10.

Traction.

One-Phase Railways.—F. E. WYNNE.—A general discussion of one-phase traction discussing the subject under the following heads: The electric motor, control, collector, trolley line, transformer stations, transmission lines and power station. The relative advantages and disadvantages of the one-phase system in comparison with the ordinary direct-current system and in comparison with the three-phase railway system are then summed up and it is thought that the one-phase system is not adapted to all branches of traction work. For instance, in cities the trolley voltage would probably be limited to a value that would preclude the use of one-phase apparatus. Again, it is evidently not suited to mine haulage in general, where space is limited and the necessary high-voltage trolley would be within easy reach of the workman. Also, certain short interurban roads may show an advantage in favor of the 550 to 650 volts direct-current system. However, the one-phase system is especially suited to general interurban work for moderate and long distances, chiefly because of the reduction in the number and cost of sub-stations and low-tension distribution system, and because of the absence of constant sub-station attendance. It is also well adapted to heavy service, frequent or infrequent, such as the electrification of an existing suburban steam service, branch lines of steam roads, through steam lines and mountain grades. On lines with numerous heavy grades recuperation of energy is of importance. Finally some illustrated notes are given on one-phase locomotives. —*Proc. Engineers' Club of Phila.*, April.

Installations, Systems and Appliances.

Shunt Resistances for Speed Regulation of Motors.—J. WAGNER.—The lefthand diagram of Fig. 1 shows the usual arrangement of a shunt motor for variable speed. It is usual to interlock the levers of the starting and of the regulating resistances in such a way that when stopping the motor the lever of the regulating resistance is brought back to its original position, so that when the motor is started again it is started with a strong field. For motors with high voltage and small output the regulating resistance becomes quite cumbersome with this method. For instance, in case of a 440-volt motor with a field resistance $S = 520$ ohms, corresponding to a shunt curve $i_2 = 0.85$ amperes, a regulating resistance may be desired for regulating i_2 from 0.85 to 0.13 amperes. The required resistance would be 2880 ohms. Although only a weak current flows through this resistance, its mechanical construction will make it rather cumbersome and expensive. The present author shows an arrangement well known from the potentiometer method can be used here to advantage; this arrangement is shown in the righthand diagram of the illustration. The regulating resistance R is connected across the total supply voltage and the field circuit S is connected in parallel with only a part a of the regulating resistance R. The author shows that under this

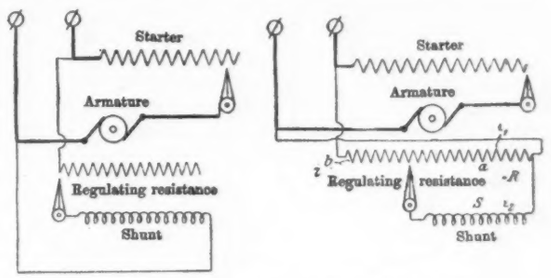


FIG. 1.—MOTOR SPEED REGULATION.

condition the current which flows through the part a of the regulating resistance R is approximately constant. If in the numerical example mentioned before R is made only two-thirds of the resistance which would be required with the other arangement or about 1700 ohms, then the maximum shunt current i becomes 1.11 ampere or 30 per cent more than i_2. Further, i_1, which is constant, is 0.26. The maximum speed i is 0.39 ampere or about three times the minimum current with the former connections. The method proposed by the author involves therefore a diminution of efficiency, but in most cases this is of small importance compared with the saving in the construction of the regulator.—*Elek. Zeit.*, May 30.

Protection of Compound-Wound Generators in Parallel.—G. H. B. BERNARD.—An article in which the author discusses the protection of compound-wound generators when operated in parallel and in which he points out the ineffectiveness of some of the elaborate arrangements sometimes used. The results of his discussion are summed up as follows: A set of compound-wound generators working in parallel and feeding to common bus-bars will be adequately protected if the series coil resistance between the equalizer and the bus-bar is so proportioned that the full-load voltage drop is the same for each coil, and the other side of each armature is protected by an automatic overload and reverse-current circuit breaker, which will open (1) instantly when the reverse current reaches a predetermined value, usually 10 per cent to 20 per cent of full-load current, and (2) after an interval of from one to five seconds (according to the overload rating of the generator), when the forward current reaches a value equal to about four times the full load. The ends of the series coil may with advantage be connected through a double-pole switch to the equalizer and bus-bar. There is then no chance of the generator being paralleled in with the equalizing switch open. Finally, it is entirely unnecessary to connect an automatic cut-out between the series coil and the bus-bar.—Lond. *Elec. Eng'ing*, June 6.

Hose Resistors.—An account of a system of electric resistors recently patented by R. von Brockdorff. Electric resistors for converting large quantities of energy into heat are employed as load-resistors for portable work and in laboratories, and also for starting large motors in the working of electric railways and central stations, and for many other purposes. Tubular resistors cooled with water comprising a metallic core surrounded by wires or conductors suitably insulated have been used in the past. The author proposes the use of metallic hose instead of such tubes, since metallic hoses possess much greater reistance than tubes of the same material, length and weight. Thus, for example, the resistance of a steel hose of 8 mm internal diameter and 130 grammes weight per lineal meter is 33.8 times that of a steel tube of the same length and weight. The carrying capacity depends primarily upon the quantity of water flowing through. With a flow of some 10 liters per minute a steel hose of 8 mm internal diameter and 1 meter length may be loaded without danger with 400 amperes at 125 volts. This property of metallic hose enables extremely compact resistors to be constructed. By the employment of hose

of large internal diameter and correspondingly increased surface and large cross-section, or in the event of connection in parallel of such resistor hose-section, quantities of electric energy with very great strengths of current can be converted into heat by the use of long hose, or with series connection of the hose-sections, such as with high tensions. In the case of very large permanent loads the water, if it should have to run through the entire length of the hose, would be unduly heated. In such cases the hose may be sub-divided, so that the various parts receive a separate supply of water, while they may be electrically connected in any desired manner. Some illustrations of such resistors are given.—Lond. *Elec. Eng'ing*, May 30.

Paris.—An article giving particulars on the agreement arrived at between the Paris Municipal Council and the Electricity Supply Companies in Paris, under which their concessions are extended to 1940. At this date, all the buildings, mains, machinery and plant will become the property of the municipality without payment. The companies must pay the city initially a minimum of $600,000 a year as royalty; and this sum may be increased considerably, in accordance with a sliding scale, if the new company, which takes over the companies' concessions from 1914 to 1940, makes more than 6 per cent dividend. There are other stringent conditions, one of which refers to the constancy of e. m. f. and frequency. Penalties may be enforced if the e. m. f. varies more than 3 per cent above or below 110 volts, or if the e. m. f at any particular point of the network rises or falls more than 1½ per cent The same limits of variation of frequency are imposed.—Lond. *Elec. Eng'ing*, June 6.

Electric Equipment of Workhouse.—An illustrated article on the electric equipment of the Brownlow Hill Workhouse in Liverpool which has an inmate population of about 4000, apart from the officers and nurses. The results of working point to a considerable saving in costs over the former arrangements, in which the laundry machinery was driven by steam engines and the lighting was by gas.—Lond. *Elec. Eng'ing*, June 6.

Central Station Running.—E. V. Shaw.—Some practical notes on the attention to be paid to special matters in the boiler house, engine room and switchboard.—Lond. *Elec. Eng'ing*, June 6.

Great Britain.—The annual statistical list of electricity supply stations of the United Kingdom. Statistical data are given on 428 stations, their equipment, etc.—*Supplement* to Lond. *Elec. Rev.*, June 7.

Wire, Wiring and Conduits.

Fireproof Cables.—An article on some tests of fireproof electric cables made by a British company. The cable is made up of the ordinary conductor insulated with a thick lap of pure Para rubber and vulcanized rubber, and taped. This is surrounded with several layers of manila paper with a solution to render it non-inflammable. Over this is a strong, flexible woven braiding of small steel wires, which in its turn is covered with more of the manila paper, the whole being finished with braiding of jute, also impregnated to render it non-inflammable. It is stated that the tests were quite successful and that the makers' claim proved true that the cable is amply able to hold the first flash and prevent ignition of the melted rubber. Even when red hot at one point, no flame was present nor did any of the incandescent portions tend to fall away from it.—Lond. *Eng'ing*, June 7.

Slide Rule.—R. D. Knight.—An article describing some of the uses to which the ordinary pocket slide rule may be put in solving the following electrical engineering problems: Given the size number of the wire; to find its resistance per thousand feet; to find the resistance per foot when the diameter of the wire is known in mils; to find the area in circular mils of a given number of wire; to find the weight per thousand feet having been given the B. and S. size number; to find the size of wire for a given drop due to resistance; to find the capacity of copper wire in amperes for open wiring as approved by the national Board of Fire Underwriters; to calculate the resistance of copper with the change of temperature.—*Jour. of Eng'ing*, University of Colorado, No. 3, 1906-7.

Units, Measurements and Instruments.

Measuring the Slip of Induction Motors.—H. Schultze.—An article contributed from the German Reichsanstalt on a new stroboscopic method for measuring the slip in induction motors. It is based on the phenomenon of electrically-excited capillary waves on dielectric liquids. The arrangement is shown in Fig.

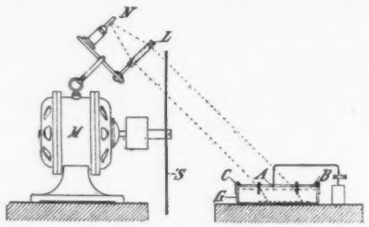


FIG. 2.—MEASUREMENT OF SLIP.

2. A cylindrical glass vessel G of about 20 cm diameter and about 10 cm height contains two electrodes, one electrode B of tinfoil, which is pressed by means of glass clamp C against the wall of the vessel and the wire electrode A of platinum which touches the surface of the water just at the center. If the two electrodes are connected to the terminals of a source of alternating current, there begins to start from the wire electrode a system of propagating ring-formed surface waves, of the double frequency of the alternating current. According to the laws of stroboscopic methods these waves appear to be at rest if the surface of the liquid is lighted with a light of the same frequency as the waves. To apply these capillary waves to a measurement of the slip of an induction motor, a stroboscopic disk is placed on the rotor of the motor. This disk has as many slits as the motor has poles. A parallel bundle of light rays passes through the slits, coming from the Nernst lamp N through the lens L and projecting the capillary waves of the water surface on a white porcelain disk on the bottom of the vessel. If the rotor would run synchronously with the revolving field which is produced by the alternating current, the bundle of light rays which fall on the water surface would have double the frequency of the alternating current. Under this supposition the system of annular capillary waves would appear to be at rest if the two electrodes a and b were connected to the same alternating current supply. Since, however, the rotor lags behind the revolving field on account of the slip, the system of waves seems to be propagated from the electrode A. If a dark rings pass per second a certain sharp mark on the porcelain disk and if n is the frequency of the alternating current which drives the motor, the slip in per cent is $100a$ divided by $2n$; if n equal 50, as is often the case in practice, slips up to 4 per cent can be easily measured, four dark rings then passing the mark per second. A slight modification of the method enables one to measure slips up to 8 per cent for a frequency of 50. This is due to a special phenomenon in the production of the capillary waves due to the fact that at the boundary of two dielectrics of different dielectric constants (like air 1, water 80) the dielectric with the higher dielectric constant tends to attract as many electrostatic lines of force as possible. For this reason the water is slightly raised at the wire electrode during the positive as well as during the negative phase of the alternating current. After having been raised, it drops and produces the waves. At the large ring-formed electrode no waves of conceivable amplitude are produced on account of the low density of the lines of force. If the capillary waves are produced on the surface of petroleum, the positive and negative half waves act with about equal force on the dielectric. But this is not the case with other dielectrics, like water and turpentine. At the surface of pure distilled water, the water is raised to a higher level during the negative half wave than during the positive one. With turpentine the reverse is the case. The result is that two succeeding capillary waves have very different amplitudes. If the surface of the liquid is instantaneously lighted after every $1/n^{th}$ second (n being the frequency of the alternating current) this difference in the amplitudes of the two waves is strongly marked. If the surface is

not lighted for an instant only, but somewhat longer so that in every $1/n^{th}$ second the surface is lighted for about $\frac{1}{2}n^{th}$ second and not lighted for the same period, then a special stroboscopic phenomenon is observed. Only the waves of large amplitude are seen. The appearance is as though there were a system of waves of equal amplitude with double the former wave length, that is, a system of waves of the frequency of the alternating current. To use this system of waves for a slip measurement the rotor of the induction motor is supplied with a stroboscopic disk with half as many slits as the motor has poles and the width of each slit is chosen so as to fulfill the above condition. If now a rings pass the mark on the porcelain disk and if n is the frequency of the alternating current the slip in per cent is 100 a divided by n. For instance, if four dark rings pass the mark per second and if the frequency is 50, the slip is 8 per cent. The waves are strongly marked as may be seen from Fig. 3. Distilled water as dielectric is most

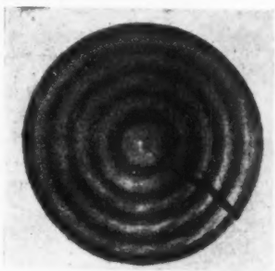


FIG. 3.—WAVES.

suitable for voltages between 200 and 4000, the most advantageous voltage being 500. If the voltage under test is higher it is easy to produce this favorable voltage of 500 between the electrodes of the vessel by connecting a large resistance in series with the vessel which has itself a resistance of 1,500,000 ohms. An adjustable water resistor in U-form is recommended. For turpentine oil the most favorable voltage is between 5000 and 8000. For higher voltages a resistor of turpentine oil having a variable resistance should be used.—*Elek. Zeit.*, May 30.

Slip Indicator.—A. S. DENNISON.—An illustrated description of a slip indicator used by the General Electric Company for taking the slip of induction motors with not more than 14 poles. (See our issue for June 10, 1905, p. 1076.) The slip

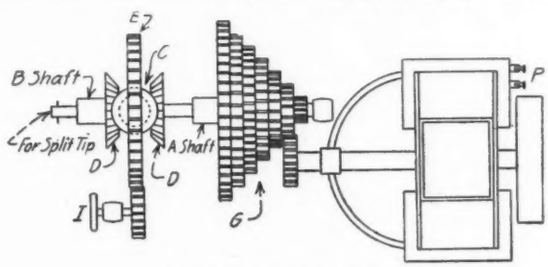


FIG. 4.—SLIP INDICATOR.

machine shown in Fig. 4 provides a synchronous shaft and a non-synchronous shaft, with a mechanical means for determining the difference between their speeds. The synchronous shaft is called the A shaft, and the non-synchronous shaft the B shaft. In preparing to take slip on a machine under test, the slip indicator is set up on a small adjustable stand, so that its shaft may be in line with that of the motor being tested. The plugs in the ends of the two shafts are connected by means of a flexible leather coupling known as a "split tip," which has a notched brass socket at each end to fit the plugs. The binding posts, P, are then connected, through a switch, across one phase of the supply circuit, on the secondary side of the transformer used for stepping down the line voltage for the voltmeter. Now the motor on the slip indicator is a four-pole machine, while the motor under test may be of almost any number of poles from two up. As the synchronous speed of any alternating current machine is equal to the number of alternations of the supply circuit divided by the number of poles, it is necessary to provide some means by which the A shaft may revolve at a synchronous speed under different circumstances. For this purpose, use is made of the nest of seven gears, denoted by G in the figure. The gear wheels have a number of teeth in the ration of 2 : 4 : 6 : 8 : 10 : 12 : 14, beginning on the right in the figure; that is, in the ratio of the number of poles on the more usual machines tested. The pinion on the synchronous motor shaft is the same size as the gear for the four-pole motor, and the figure shows the synchronous motor pinion on this gear, but the synchronous motor may be shifted on the base of the machine and fastened down by pins, so as to run with any gear of the set. Thus for a two-pole motor it would be geared to the smallest wheel, and for a 14-pole to the largest wheel of the set. Between the A and B shafts there is the differential gear, which is the essential part of the device. The differential gear consists of two opposing bevel gear wheels, D D, Fig. 5, holding between them two bevelled

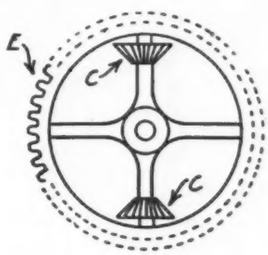


FIG. 5.—DIFFERENTIAL GEAR.

pinions, C, set on the diameter of a larger gear wheel, E, used for starting. If the central wheel carrying the pinions is held fast by grasping the starting wheel I, the rotation of the B shaft is transmitted to the A shaft and thus the motor is brought up to the speed of the motor under test. Now when the switch is closed and the synchronous motor falls into step, the A shaft begins to travel faster than the B shaft. The pinion wheel is then immediately released, whereupon it will revolve at one-half the difference between the speeds of the A and B shafts. That is, to get the slip, count the revolutions of the pinion wheel and multiply by two. The action of the differential gear is made plain by considering a cylinder, C, Fig. 6, revolving between planes N and S. If N travels at the rate of 10 ft. per second, and there is to be no slipping, C must displace its center of gravity so that the points of contact will revolve at the same rate of speed. Hence, an equal amount will be added to the speed of N and subtracted from that of S, or C

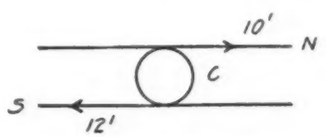


FIG. 6.—DIAGRAM SHOWING PRINCIPLE OF DIFFERENTIAL GEAR.

will move to the left at the rate of 1 ft. per second.—*Jour. of Eng'ing*, University of Colorado, No. 3, 1906-7.

Testing Lamps.—H. PEDHEUX.—An article discussing in detail the precautions which must be taken in the use of torsion or rotation wattmeters for measuring the power consumed in tests of incandescent lamps. The formulas of the general cases are given and numerical examples are added.—*L'Eclairage Elec.*, June 1.

Miscellaneous.

Electric Industry in Germany.—An account of a report by Schwabach on the electric trade in Germany during 1906. Business was exceedingly brisk, the chief customer being the German mining and metallurgical industry, which is assiduously replacing steam by electric power. The most noteworthy developments in this connection are the success of electrically-driven reversible rolling mills and the construction of a con-

tinuous-current motor for a converter blast, having a rating of 2000 horse-power and operated at 500 volts to run at speeds of 80, 40 and 22 r. p. m. Electric railways are also being extended, especially for suburban traffic. The Felten-Guilleaume-Lahmeyer Company has practically absorbed the Swiss firm of Escher-Wyss & Company, whose specialty is the construction of turbines. The Allgem. Elek. Ges. in Berlin has paid 11 per cent dividends in 1906, against 8 in 1903. Their number of employees has increased from 15,000 in 1902 to 34,000 in 1906. The telephone system, which is owned and operated by the government and belongs to the Post Office Department, has also made rapid progress. The number of towns with local telephone exchanges has increased from 2157 in 1901 to 4062 in 1906, the number of public pay stations from 13,000 to 22,000, the number of telephone instruments from 250,000 to 537,000. At the end of March, 1906, the rural population of Germany had more than 8700 "public telephone stations" at their disposal, while Berlin had 77,000 and Hamburg 32,000. The number of telephone conversations in 1906 exceeded for the first time 1,000,000. With respect to foreign trade, Germany is to be considered chiefly as an exporting country, her principal customers being Belgium, Great Britain, the Netherlands, Sweden, Argentina and Italy, while imports are derived exclusively from France, Great Britain and Switzerland.—Lond. *Elec. Eng'ing*, May 30.

Electrotherapeutics.—A note on experiments made by E. R. Morton at the London Hospital with the high-frequency spark as a local application. He considers the high-frequency spark as a very valuable form of local stimulant with properties peculiar to itself, while it is always under perfect control in the hands of somebody who is accustomed to its use. He first mentions a case in which he applied the high-frequency current to treat the head of a patient for alopecia areata. He used a vacuum glass electrode connected to the top of the resonator, rubbing the electrode over the bald patches until a bright erythema was produced, which in this case took not more than three or four minutes to each patch. Treatment in this manner was carried out three or four times a week, and after about six months hair was growing vigorously all over the previously bald patches, and finally the patient had "a splendid head of hair, which has maintained its good condition ever since." This was in 1904. It is also mentioned that "port-wine stains or marks, which at times constitute a very serious disfigurement, can be entirely removed by this method when they are only of moderate depth and extent, while the more severe cases can be at least very greatly improved. A great advantage of the method is that the normal texture of the skin is quite unimpaired, thus differing from chemical agents and electrolysis." —Lond. *Elec. Engineer*, June 7.

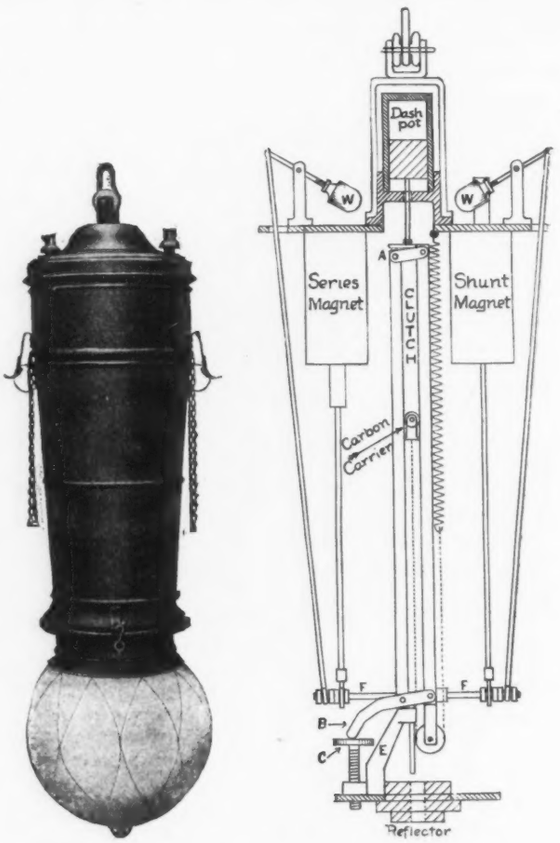
(British) Institution Electrical Engineers.—An account of the annual report. The total number of members has increased from 5973 in 1906 to 6186 in 1907. J. J. Thomson has been elected an honorary member. The work of the organization of the library has been continually carried on.—Lon. *Elec. Eng'ing*, May 30.

British Municipal Electrical Association.—This year's convention is to be held at Sheffield under the presidency of S. E. Fedden, electrical engineer to the Sheffield corporation. Some notes are given on the electricity supply and tramways in Sheffield with an outline of a programme of the convention and personal notes with portraits of prominent members. Considerable electric power is used in Sheffield for industrial purposes, electric heating, etc.—Lond. *Elec. Eng'ing*, June 20.

Constant Potential Luminous Arcs.

A new luminous arc lamp known as the "Flamor" has been brought out by Mr. P. H. Klein, Jr., of 33-37 Bethune Street, New York City. It is herewith illustrated in Figs. 1 and 2. It is arranged to burn two in series on 100 to 125 volts and two, three or four in series on 200 to 250 volts; and it uses for standard size 15¾ in. (400 mm) carbons.

The "Flamor" consists essentially of a simple, practically frictionless mechanism for maintaining a flame arc of constant voltage at the tips of a pair of downwardly pointed carbons by simultaneously raising or lowering them along their converging paths. With the current off, the carbons butting at their tips sustain each other. When the current is turned on, the series magnet (and counterweights *WW*) lift the clutch which grips the carbon-carrier, the moment the extended link *B* leaves the table *C*. This movement separates the carbon at their tips and strikes the arc, drawing it out till the shunt magnet holds it at the adjusted voltage. The suspending means now slowly sinks till the carbon-carrier is released by the clutch, when the link *B* again bears on the table *C* to feed the carbon. In the "Flamor" this operation is practically "sneak-feed." As



FIGS. 1 AND 2.—CONSTANT POTENTIAL LUMINOUS ARC LAMP.

the carbons when not in operation are supported by each other and when in operation are supported from the clutch, the "Flamor" has no shadow casting device below the carbons, which the arc might attack. As will be observed the clutch is direct-acting and operates simply by gravity. The carbon suspension practically floats in the magnetic field of the regulating solenoids, so that it is free from frictional, sluggish conditions in the mechanism.

The "Flamor" lamp is supplied also in the double form, at slight extra cost; and in iron and copper or all copper casings; although other casings, such as burnished or polished copper or oxidized, can be specified.

Liquid Conveying by Ejectors.

Attention has been called recently to the use of ejectors as liquid elevators and conveyors, serving in this manner as a substitute for steam pumps, siphons, etc. Anything in the nature of a liquid, if not too thick or viscous, can be transported by ejector from one level to another, or horizontally any limited distance. This field of work, as occupied by the "XL-96" type of the Penberthy Ejector Company, of Detroit, Mich., includes

wells, tanks, factories, ships, distilleries, dye works, paper mills and other industrial plants, where compactness and portability

EJECTOR.

allow the appliance to be placed near the work to be done, and where there is notable resultant economy.

Power Plant at the Charleston Navy Yard.

Piles have just been driven to support the foundations of what is to be known as Building No. 32 at the United States Navy Yard, Charleston, S. C. This is to be the central power plant which will supply electrical energy first of all for the operation of the new concrete and granite dry dock, the largest of its kind in the world, then for the lighting of the yard and the various buildings, and also for the driving of the machine tools and other apparatus in the various shops distributed throughout the yard. The plant will be erected with an appropriation authorized by act of Congress April 27, 1904. The several small and scattered generating stations will now be replaced by the one large central power station and the improvement thus instituted will greatly enhance the present facilities at this yard. The contract for the entire mechanical equipment of this plant is in the hands of Muralt & Company, engineers, of New York. The work to be carried out comprises the installation of a complete generating equipment aggregating 1600 kilowatts and miscellaneous auxiliary apparatus, such as air compressors, pumps for the dry dock, capstans, etc.

The power plant building is a structure of steel and masonry of the latest and most approved design. It will occupy a site 120 ft. x 220 ft., the boiler and engine rooms having about the same floor area and being divided by a wall which runs the entire length of the building. The roof is of the usual trussed girder type. Many large windows afford excellent daylight illumination to the interior. There will be four main generating units of General Electric make; two of 500 kilowatts and two of 300 kilowatts capacity each. They are to be of the standard Curtis type, the large size being vertical and the small size horizontal. The generators are all wound for 2300 volts, three-phase alternating current, of 60 cycles per second. The turbines operate with steam at 150 lbs. pressure, 100 deg. F. of superheat and with 28 ins. of vacuum, and are guaranteed to have a steam consumption at full load not exceeding 18.4 lbs. per kw-hour for the 500-kw unit and 19.5 lbs. per kw-hour for the 300 kw-unit. A complete central oiling system is provided for the lubrication of the present turbine units and 1000 kilowatts in future additions. The two exciter sets are each of 35 kilowatt capacity, compound wound for 125 volts. One is driven by a simple non-condensing vertical steam engine of the self-lubricating enclosed type; the other is driven by a 50-hp, three-phase, 60-cycle, 2300-volt induction motor.

To provide a direct-current supply, two motor generator sets will be installed, each consisting of one 150-hp, three-phase, 60-cycle, 2300-volt induction motor directly connected to two 50-kw, 110-volt, compound wound, direct-current generators. The field rheostats are designed to vary the generator potential from 90 to 135 volts.

A bank of three 37.5-kw, oil-insulated, single-phase transformers, stepping down the potential from 2300 to 230, furnish a low voltage supply for station lighting and other purposes.

There will be four water-tube boilers of 350 horse-power nominal rated capacity, the four boilers set in two batteries of two each. The boilers are designed for a working pressure of 200 lbs. per sq. in. and they will withstand operating at 50 per cent above their rated output for periods of 12 hours continuously without showing signs of strain or deterioration. The boilers are now furnished by the Heine Safety Boiler Company. Each boiler has 3500 sq. ft. of actual heating surface below the waterline and about 80 sq. ft. of effective stoker grate surface. Each boiler will be provided with a Foster superheater of sufficient capacity to add 100 deg. F. to the steam at 150 lbs. gauge. Arrangements are made so that both superheated and saturated steam can be drawn from the boilers. These boilers will be fitted with Murphy automatic mechanical stokers, guaranteed to burn bituminous coal without smoke and to burn sufficient bituminous coal to maintain the boiler in operation under a continuous overload of 50 per cent. An enclosed steam engine of the proper size will drive the stoker mechanism. The evaporative efficiency of these boilers, with feed water at a temperature of 150 deg. F., boiler pressure of 150 lbs., steam at a 100 deg. F. of superheat, fuel (bituminous or semi-bituminous) of a calorific value not less than 13,500 B. T. U.'s per pound dry, draft at damper not exceeding 0.5-in. water gauge, will not be less than the equivalent of 10 lbs. of water from and at 212 deg. F. per pound of dry coal.

There will be a brick smokestack, aided by an induced draft apparatus. A fuel economizer of the Sturtevant make will be installed on a supporting frame work of steel I-beams construction. It will consist of 28 sections of 10 tubes each, with a total heating surface of about 3400 sq. ft. Induced draft will be provided by the installation of two full housing, steel-plate exhaust fans, each driven by a direct connected vertical enclosed engine. This equipment, which is made by the American Blower Company, is designed to create a draft of not less than 0.5 in. of water when discharging 52,000 cu. ft. of gas per minute at about 550 deg. F., or when discharging 21,500 cu. ft. at about 300 deg. F. The fan housings are of the usual standard steel plate and angle iron construction. The fans themselves consist of eight blades and are 9 ft. 6 ins. in diameter. The flue connecting the boilers, economizer, fans and stack will be constructed of ¼-in. steel plates with angle iron stiffeners. The entire surface of the flue will be covered with 2 ins. of asbestos (or 85 per cent magnesia) blocks, and a ½-in. coat of hard plaster on wire netting leaving a 1 in. air space between it and the first covering. The arrangement of the dampers in the flue is such as to allow the gases to pass entirely through the economizer, entirely through a bypass around the economizer, or partly through both.

A thoroughly up-to-date feed water set is provided, consisting of one hot well, two boiler feed pumps, the economizer mentioned above, two feed water heaters and a water meter. The hot well consists of a vertical cylindrical steel shell, 4 ft. in diameter and 7 ft. high, provided with an automatic float valve. It is covered with non-conducting material in the shape of magnesia blocks and asbestos-magnesia cement. The feed water heaters are of the closed vertical type, with straight water tubes contained in a cylindrical cast-iron shell. These heaters are of the C. H. Wheeler Manufacturing Company's make and consist of 1¼-in. seamless drawn brass tubes, presenting an effective heating surface of 265 sq. ft. The water meter, of the Worthington make, has 4-in. inlet and outlet connections and has a capacity of 150 gals. of hot water per minute. The boiler feed pumps are of the duplex outside packed plunger type, Blake pattern, having 6 in. x 10 in. water cylinders, designed to operate against a boiler pressure of 200 lbs. The steam cylinders will operate at a steam pressure of 50 lbs.

Each 500-kw turbine unit will be provided with a complete condensing equipment. The two 300 kilowatt units will have one equipment in common. Each equipment is to consist of a surface condenser, hot well, cooler, hot-well pump, circulating pump and dry vacuum pump. The equipment is designed to condense 12,000 lbs. of steam per hour, and to maintain a vacuum of 28 ins. at the turbine exhaust, with con-

densing water at a temperature of 72 deg. F. The condensers, made by the Wheeler Condenser & Engineering Company, are of the horizontal cylindrical pattern. The tubes are seamless drawn tinned brass, and present a cooling surface of about 2000 sq. ft. per condenser.

The hot-well pumps are of the horizontal centrifugal type, arranged for direct connection to a 3-hp motor. They are capable of delivering 30 gals. per minute against a total head of 80 ft. The circulating pumps are 8-in. horizontal, volute, centrifugal direct connected to a vertical, fully enclosed, automatic oiling steam engine. These units will deliver 2000 gals. of water per minute continuously against a head of 20 ft. The dry vacuum pumps are of the rotative steam-driven type, having a displacement of 150 ft. per minute.

In addition to the electric generating plant, the engine room of the power house will contain two air compressors of Laidlaw-Dunn-Gordon manufacture. They will be of the horizontal steam-driven type, with Corliss type across compound steam and air cylinders. These machines will deliver 1200 and 2500 cu. ft. of air per minute respectively at a gauge pressure of 100 lbs. per square inch. For condensing the steam from these air compressors a condenser equipment will be installed similar to that provided for the turbines, except that this condenser will have 1000 sq. ft. of cooling surface and a combined air and circulating pump with a 10-in. steam cylinder, a 14-in. air cylinder, a 14-in. water cylinder, and a 12-in. stroke.

The present appropriation does not cover the coal handling equipment, but there will be ultimately installed complete facilities, including coal pockets of 50 tons capacity each, weighing scales and chutes for each of the four boilers, a receiving hopper, belt conveyor capable of delivering 950 lbs. of coal per minute, a coal crusher to reduce run-of-mine bituminous coal to 2½-in. size, bucket elevator, flight conveyor, runways, etc. This equipment will elevate the coal from the bunkers in the basement to the crusher and distributing troughs above the hoppers, whence the coal is to be fed directly through the chutes to the stokers.

In a separate building surrounding the pump well for dry dock No. 1, there will be installed a series of electrically-driven pumps for drawing the water out of said dock. Building, as well as pumps, will be furnished by the Camden Iron Works, The four main pumps will rest on a raised concrete foundation at the bottom of the pump well and will have a capacity of 140,000 gals. per minute when pumping out the dock against a head from zero to 33 ft. This performance will be attained with the motors consuming not more than 1000 kilowatts. These pumps are proportioned for suction and discharge pipes 36 ins. in diameter. The two 12-in. drainage pumps will be located on the floor at the top of the pump well and will have a capacity of 3500 gals. per minute when operating at 500 r. p. m., against an average head of 38 ft. The suction pipe is 16 ins. in diameter. The pumps when operating under the conditions mentioned will require about 50 kilowatts of electrical power. These pumps are all of the centrifugal type with vertical shafts, direct driven by electric motors. The latter are three-phase, 60-cycle, variable speed induction motors, the large ones wound for 2200 volts and the small ones for 220 volts.

There are to be seven electric dock capstans, located around dry dock No. 1, three on each side of the dock and one at the head. These capstans will be of the latest improved type with gearing in the base for reducing the speed. They will be mounted on pedestals firmly bolted to the foundations and operated by a worm secured to the motor shaft. Motor gearing and connections will be located entirely below grade so as to offer no obstruction to lines being laid to the capstans. The six small capstans will be capable of developing and sustaining a pull on the rope of not less than 12,000 lbs. at a speed of 17 ft. per minute, or 29,000 lbs. at a speed of 7 ft. per minute. The larger capstan at the head of the dock will be capable of developing and sustaining a pull on the rope of not less than 14,000 lbs. at a speed of 30 ft. per minute or 35,000 lbs. at a speed of 12 ft. per minute. All capstans will be arranged for driving in either direction by hand or by electric motor. The motors to be of the variable speed, three-phase induction type, completely enclosed, water tight, and designed for operation on 60 cycles, 220 volts. The leads from the rotor windings are carried through a hollow shaft to the collector rings. The speed control is effected by varying the amount of external resistance introduced across the collector rings. Each motor is provided with a reversible three-phase controller, adapted for cutting resistance in or out of the secondary circuit of the motor. Controllers are so designed as to permit of continuous operation at reduced speeds.

The control of this entire work is in the hands of the Bureau of Yards and Docks of the Navy Department, Rear-Admiral R. C. Hollyday being chief of the bureau, and Dr. N. M. Hopkins, electrical engineer. The officer in immediate charge at the Charleston Navy Yard is Mr. W. H. Allen, civil engineer, U. S. N. Mr. J. F. W. Bunsen is resident engineer in charge of the work for the general contractors.

Electrification of the Largest White Lead Factory in America.

The National Lead Company owns the largest white lead plant in America. It is known as the Atlantic White Lead & Linseed Oil Works and covers two entire city blocks in Brooklyn, at the foot of Gold Street, not far from the Brooklyn Bridge. This factory, in addition to producing the highest grade of carbonate of lead or white lead, turns out sheet lead, tin and lead pipe, solder, babbitt and type metals, and linseed oil. There are several other factories of the National Lead Company in the vicinity of New York, one known as the Bradley Works, in Brooklyn; another plant known as the Jewett Works, at Port Richmond, S. I., and the Crooke Smelting and Refining Works on Long Island. The National Lead Company has for some time been introducing electric power distribution in its several factories. About four years ago, the Jewett Works built an extension, in which electricity was used exclusively; the Bradley Works were completely electrified about two years ago, and within the last year the Atlantic Factory has been entirely transformed. All these changes were carried out under the direction of Mr. Henry Floy, consulting engineer, of New York City, who has been acting for the National Lead Company for the last eight years.

Comparatively recently, but preceding the electrification of the Atlantic Factory, the boiler plant was reconstructed and five 250-hp Babcock & Wilcox water-tube boilers were installed, together with a 150-ft. self-supporting steel stack. Until last year these boilers supplied steam to some 15 different engines and 20 steam pumps, scattered through the various departments of the factory, in addition to furnishing necessary steam for oil refining. A year and a half ago Mr. Floy was requested to submit a complete report covering the estimated cost and probable saving to be effected by substituting electric motors for the various steam engines and steam pumps. Upon receipt of this report the executive committee adopted in general the recommendations and appropriated about $60,000 to carry out the work. The report of the engineer contemplated abandoning practically all of the engines and steam pumps then in use, and substituting therefor an economical engine located close to the boiler room and of sufficient capacity to furnish all the power required throughout the establishment.

The boiler plant having been recently installed was found, upon test, to be giving satisfactory results, therefore, no changes were made in the boiler plant; although the engineer reported that its economy could be somewhat increased by introducing economizers. Formerly there was a small engine room adjoining the boiler room in which a compound engine was located, driving, by direct connection, the main shaft in the basement of the adjoining white lead mill. By means of

bevel gears and vertical shafts, power was transmitted from this main shaft to the floors above and thence further distributed by belts and gears. There was also another small engine room about 200 ft. from the boilers in the basement of the oil mill, where was located a simple Corliss engine, which furnished power for the oil mill by means of belts, shafting and chain drives. The engine room adjoining the boiler plant has been reconstructed and enlarged to accommodate the entire power generating equipment.

The new main unit, in the reconstructed engine room, is located so as to drive by direct-connection through a 200-hp friction clutch, the main shaft in the first floor of the white lead mill, to which are directly belted or geared all the large and heavy, slow-moving machinery required in the manufacture of white lead. The new and economical engine installed is an 18 in and 36 in. x 42 in. tandem compound, 100 r. p. m. condensing Corliss engine, manufactured by the Harris Corliss Steam Engine Company, of Providence, R. I. The engine is supplied with steam at 150 lbs. at the throttle, the safety valves on the boilers being set at 160 lbs. On the engine shaft, connected to the mill shaft, is mounted a massive flywheel, as well as the rotor of a 350-kw, two-phase, 60-cycle, 240-volt revolving field generator and a pulley driving, by means of belt, a 22½-kw exciter, both electrical machines being of Bullock manufacture. The condenser used is of the "jet" type, manufactured by the Watson Machine Company, of Paterson, N. J. Salt water is used for condensing.

The auxiliary generating unit, which is used as reserve or at times of very light load, consists of a simple 20 in. x 42 in. Corliss engine that was formerly used for driving the machinery in the oil mill. It has been removed to the present engine room and belted to a 200-kw, two-phase, 60-cycle, 240-volt revolving armature "compensated" type, Westinghouse generator and belted exciter. Increased demands for power have recently led the company to conclude to install a larger direct connected unit in place of the belted rig.

Along one side of the wall has been erected a very complete Stanley G. I. marble switchboard, equipped with a full line of ammeters, indicating and recording wattmeters, synchronizers, voltmeters, circuit breakers and switches.

As it will be seen from the foregoing, the new engine furnishes, by direct-connection to the main shaft, a large part of the power required in the white lead mill, as under the old régime. Instead, however, of transmitting the necessary power to the third and fourth floors by means of bevel gears and vertical shafts, motors belted or geared directly to the machines which they drive, or in some instances, to a countershaft driving a group of machines, have been substituted. The main shaft now furnishes power only to the machinery on the first floor, and such on the second floor as may be conveniently and economically belted to it. There are 13 two-phase induction motors, ranging in size from ¾ horse-power to 30 horse-power employed in driving machinery in the white lead mill. Some of the motors are of special slow-speed design in order to meet the requirements of the slow-moving machinery necessarily employed in the white lead industry. The conditions of service are varied, the motors operating elevators, conveyors, pumps, pulp machines, mixers, screens and various other apparatus.

In the oil mill there are 24 two-phase motors varying from ½ horse-power to 50 horse-power. The motors driving direct-geared triplex power pumps of Dean manufacture, used for forcing the oil at high pressure into accumulators, are one of the most interesting features of the electrical installation. When it is recognized that a constant pressure of about 4000 lbs. per sq. in. must be maintained steadily day and night in the accumulators, that the requirements are intermittent, at one time oil in large quantities being required, while at another time no oil is being used, that the entire feed supply must be automatically maintained, regulated and controlled—the intricacies of the problem will be acknowledged. Each pump is equipped with a by-pass valve, thereby permitting continuous operation of the motors, the valves being actuated by the height of the accumulators. Thus the motors and pumps are running practically idle when the accumulators are full, but are instantly prepared to take care of any maximum demands to meet requirements.

Two motors furnish all the power for the lead-pipe departments. One motor is belted directly to one of the three triplex pressure pumps which operate the lead presses; the second motor is belted to a countershaft which drives the other two pressure pumps, a small lead roll and a few machine tools, also the elevator used in the lead trap department. The load on these lead press motors is fluctuating and varies from no-load to 25 per cent overload, but is satisfactorily carried by the motors installed. Induction motors are also used to drive the dock hoist, machine shop tools, the blacksmith forge blower, and even the horse clipping machine in the stable.

The electric drive has already proven a profitable and satisfactory improvement at the Atlantic branch; a large part of the belting and shafting, which encumbered the factory in the old régime, has been removed, thus securing additional floor space, better lighting, economizing the danger to employees; while the greater economy of the new system already shown promises to effect the saving of the annual operating expenses estimated by the consulting engineer.

The 47 induction motors installed were furnished partly by the Westinghouse Electric & Manufacturing Company and in part by the General Electric Company. The wiring installation complete, including both the power and lighting systems, was carried out by L. K. Comstock & Company, of New York; the engine foundations and receiver pit were built of concrete by the Turner Construction Company. The Berlin Construction Company furnished the heavy plate girders and iron work for reconstructing and enlarging the engine room.

In view of the complexity of the installation and the successful carrying on of manufacturing while the changes were being made, great credit is due the various contractors for their co-operation with the consulting engineer and the local representatives, H. P. Cavarly, superintendent, and A. L. Larwill, chief engineer of the Atlantic Factory.

Ventilation of the Boston Subway.

In the Boston subway the change of air once in ten minutes, which is produced by a number of fans, is sufficient to meet all ordinary conditions. But the corresponding rate of flow which is only one linear foot per second from each station toward each center of discharge is extremely low. Such a low rate of flow (which is a measure of the vacuum produced) would leave any ventilating system practically powerless to overcome the effect of ordinary atmospheric changes. A difference of only .01" of water is sufficient to produce a velocity about six times greater than that planned for the subway. The result when large open portals and numerous entrances and exits, to say nothing of moving trains, afford ample opportunity for the creation of pressure differences much greater than .01" has been to render the ventilation decidedly erratic.

Under these conditions the fan becomes merely local in its effect. It is practically powerless to control the direction of such currents at such differences as exist in the subway. In a word, so long as the subway connects through large openings with the outer atmosphere it is impossible for fans of the capacity here installed to properly control the flow of air. The trouble in the case of this installation is not, it is stated, with the individual fans, which are of the Sturtevant open cone-type, but with their size as determined by the subway engineers, for a fan can mechanically meet any desired requirements. The problem is one of volume and velocity, which must be sufficient to insure the maintenance of a pressure difference which cannot be overcome by atmospheric conditions. The entire installation suggests the false economy which is all too likely to be observed when ventilation is to be provided.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—General trade during the week was good, especially in summer specialties, and there was a liberal amount of increase in goods shipped over the various transportation lines. Improvement has become more pronounced in distribution of seasonable merchandise, and with the reduction of retail stocks there is a broadening of interest in jobbing and wholesale shipments of fall and winter lines. Weather conditions have again favored both trade and agriculture, rapid development of the crops being potent for good in commercial departments. Taken as a whole, leading wholesale lines will show a six months' business 5 to 10 per cent at least in advance of 1906. Very much the same report is made by leading industries, which have generally surpassed records made in the first half of a year ago. There was a distinct sentiment of confidence, and mercantile collections are much more prompt. Little machinery is idle in the leading industries. New wage scales for July 1 have been atranged with little friction, few controversies of importance remaining unsettled. Building operations are large, although less than contemplated, owing to financial conditions. In the pig iron trade there was a further slight easing in prices of third quarter iron and furnaces were reported catching up with orders on their books. Business in steel bars was good. Cast-iron pipe was fairly active and structural material was in fair request, the demand being mostly for railway bridge work. New business in steel rails was not heavy, but some large contracts are pending a settlement of negotiations for an improved rail. Metal markets were generally a little lower. Copper went off about ⅜ cent, and demand was light, even at the decline, but large sellers are talking confidently of the future. The closing prices are 23½ cents for lake, 22⅛ cents for electrolytic and 21⅛ cents for casting stock. *Bradstreet's* reports 150 failures in the United States during the week, against 165 for the previous week, and 146 for the corresponding week last year.

ALLIS-CHALMERS TURBOS.—According to advices from the company, Allis-Chalmers turbo alternators are now in operation in the power houses of Utica Gas & Electric Company, Utica, N. Y.; Westchester Lighting Company, New Rochelle, N. Y.; New York Edison Company, Bronx station; Dayton Lighting Company, Dayton, Ohio; Brooklyn Edison Company, Gold Street station; Memphis Consolidated Lighting & Power Company, Memphis, Tenn.; city of Jacksonville, Fla.; Western United Gas & Electric Company, Aurora, Ill.; Kokomo, Marion & Western Traction Company, Kokomo, Ind.; Meriden Electric Company, Meriden, Conn.; Electric Company of America for Canton, Ohio; Interstate Railway Company, Wilmington, Del.; National Cash Register Company, Dayton, Ohio. Other units ranging in capacity from 500 kilowatts to 6000 kilowatts, many of them being on repeat orders, are in process of erection or nearing completion in the shops of Allis-Chalmers Company for the Western Canada Coal & Cement Company, Calgary, Can.; Jamestown Woolen Mills, Jamestown, N. Y.; Savannah Lumber Company, Savannah, Ga.; Flatbush Gas Company, Brooklyn, N. Y.; Indianapolis, New Castle & Toledo Railway, New Castle, Ind.; Helderberg Cement Company, Howes Cave, N. Y.; Kings County Electric Company, Gold Street station, Brooklyn, N. Y.; Citizens' Light, Heat & Power Company, Johnstown, Pa.; Delaware, Lackawanna & Western Railroad Company, for the Hampton Collieries, Scranton, Pa.; Bisbee Improvement Company, Bisbee, Ariz.; Binghamton Light, Heat & Power Company, Binghamton, N. Y.; Brush Electric Light & Power Company, Galveston, Tex.; Northampton Lighting Company, Northampton, Mass.; Calumet & Arizona Mining Company, Bisbee, Ariz.; Pacific Mills, Lawrence, Mass.; American Thread Company, Watuppa, Mass.; Virginia Passenger & Power Company, Richmond, Va.; and Milwaukee Electric Railway & Light Company, Milwaukee. Recent sales include units for the Illinois Steel Company, South Chicago, Ill.; Brush Electric Light & Power Company, Galveston, Tex.; Savannah Lumber Company, for Savannah Lighting Company; American Gas & Electric Company, Scranton, Pa.; Madison Gas & Electric Company, Madison, Wis.; Cedar Rapids & Iowa City Railway & Lighting Company, Cedar Rapids, Ia.; L. L. Numm, Provo, Utah.

A TELPHER MAIL SYSTEM has been devised by Mr. W. C. Carr, of Buffalo, N. Y., and the Automatic Transportation Company is incorporated with an authorized capital of $2,000,000. The offices are in Buffalo, N. Y., at Nos. 7 to 9 Lewis Block. The officers of the company are: William C. Carr, president; Joel H. Prescott, secretary-treasurer, and Eugene L. Falk, attorney. The directors are the following: W. C. Carr, Joel H. Prescott, George W. Carr, Geo. H. Winkinson and A. C. Buell, all of Buffalo. Branch offices have been opened in Cleveland and Pittsburg. The development of the system is already under way. Orders have been placed with the Carnegie Steel Company for rails, and other details for construction are being attended to with expedition. Within the next few months the first out-door line will be completed. The system comprises a series of Y-shaped metal poles supporting a double steel track, the length of which is limited only to the necessity. Save at the stopping places the tracks are from 12 to 20 feet above ground—far enough so that even extraordinary traffic is not interfered with. At the stations it is depressed and entirely accessible. Where used to supplant the present free delivery service, these lines will run in loops from a central station, the whole being in shape not unlike a daisy, with its petals. From the central point, the motored carriages are sent out, the mail and parcels for each farmer being arranged in boxes and attached to the carrier in the order in which the farmers' residences are located. The carriers are sent on their way at the rate of 25 miles an hour. Approaching a house for which it has mail, the carrier slows down automatically, deposits the mail in a box and locks it, picks up the mail the farmer has deposited in the outgoing box, rings the bell in the farmer's house, announcing the delivery, then proceeds on its way, instantly picking up its speed of 25 miles an hour. The cost of each round is said to be 5 cents. The point of contact between the motor car and the rail is underneath, in an inverted-V-shaped groove, thus protecting it from the elements.

ADIRONDACK SINGLE PHASE.—The Paul Smith Electric Light, Power & Railroad Company, which is the owner of a seven-mile spur from Lake Clear Junction to Paul Smith's, is proposing the equipment of the line by electric power. A single-phase locomotive will be used with catenary overhead construction. The potential of the trolley wire will be 5500 volts and the locomotive will be equipped with mercury arc rectifiers which will deliver direct current to four General Electric 57 motors. Twelve 40-ampere rectifier tubes will be used with the necessary transformers. This locomotive, it is expected, will be able to haul three Pullman cars on a level at the rate of thirty miles per hour. Electrical energy will be taken from the power plant of the Paul Smith Company, which is developing a water power at Union Falls, eighteen miles distant, from which power will be transmitted at 22,500 volts. It is hoped to have the line in operation this summer.

HUDSON RIVER TROLLEYS.—The Hudson River & Eastern Traction Company, which is proposing to build an electric railway to connect Peekskill, Ossining and other towns along the Hudson River with the county seat at White Plains, won a victory last week at a special term of the Supreme Court at Nyack, when Justice Tompkins dissolved the injunction against it obtained by the Westchester Traction Company. The Hudson River company recently gave a mortgage for $5,000,000 to the Colonial Trust Company and will now proceed with construction. The road will first be completed in Ossining and then extended to Briar Cliff Manor, Pleasantville, Sherman Park, North White Plains and White Plains proper. The company was awarded a franchise last week which takes it to the White Plains line, and an application will be made to enter the village this week, as a certificate of public necessity has been filed.

IMMENSE ORDER FOR GAS ENGINES.—The largest single order for gas engines ever placed in this country, and for the largest engine of this type ever built, has recently been awarded by the United States Steel Corporation to Allis-Chalmers Company, Milwaukee, Wis. Within the past year this company has taken orders for 36 gas engines of 4000-hp each, or an aggregate of 144,000-hp, 25 of which are to be installed as a part of the mammoth new plant now in course of construction by the Steel Corporation, at Gary, Ind.; seven for the Homestead Plant of the Carnegie Steel Company, and four in the South Chicago works of the Illinois Steel Company. These large gas engines weigh 1,500,000 pounds apiece. Their great size is also demonstrated by the fact that the shaft of each measures three feet in diameter. It will require 2300 cars to transport these machines from the works of the Milwaukee company to the different plants of the Steel Corporation, where they will be installed. The wide use of gas engines by the United States Steel Corporation marks an important step in the progress of steel manufacture in this country, as they are designed to operate upon the hitherto "waste" gas developed by the blast furnaces; thus inaugurating an important economy in steel production. The majority of the Allis-Chalmers gas engines on order will drive electric generators of standard Allis-Chalmers type, 25 cycle, three-phase. In addition to the gas-driven electrical units, orders have also been placed with the Allis-Chalmers Company for 12 gas-driven blowing engines. The Indiana Steel Company, Gary plant, will have eight blowing engines, and the Homestead plant of the Carnegie Steel Company has ordered the remaining four units. Each blowing engine has a capacity of 3500 hp, and will deliver 30,000 cu. ft. of free air per minute against a pressure of 18 lbs. per sq. in. which is ordinarily the maximum. All of the gas-driven blowing engines purchased by the Steel Company's plants will be equipped with "Slick" type blowing tubes, the American patent rights covering which are owned by Allis-Chalmers Company.

LONG ISLAND TROLLEYS.—The New York State Board of Railway Commissioners has given its certificate of necessity to the Queens Borough Street Railway Company for a trolley road to run along Van Alst avenue, Astoria, from the present center of the district, at Flushing avenue, through East River Heights, to the new settlement of the Astoria Light, Heat & Power Company. The line will be less than a mile in length, and for 3000 feet will run through the property of the Rickert-Finlay Realty Company, whose officers comprise most of its board of directors. It will be an independent company, but will either extend its line down to the Ninety-second street ferry or arrange for transfers to that point, only six blocks distant. In either case, the time from East River Heights to the ferry will be only five minutes. The road's application for a franchise has been filed with the city's bureau of franchises, and will be heard by the Board of Estimate and Apportionment on July 8. The Astoria Light, Heat & Power Company is at present under the necessity of transporting some 1500 of its employees every day from Manhattan to Astoria on tugs, on account of the lack of housings for them near their work. This condition is, of course, anomalous with families living in the congested part of the city while the bread winner earns his living amid suburban surroundings, but must continue until the company builds its groups of flathouses and the buyers at East River Heights finish their construction work. In the meantime the new trolley line will be of enormous benefit to both properties, and, in fact, to the whole section of Astoria lying along the East River north of Ninety-sixth street.

THE CARSTARPHEN ELECTRIC COMPANY, Denver, Col., has removed its entire establishment to larger and more commodious quarters at Broadway and 20-22-24-26 Colfax Avenue. The steadily increasing demand recently for panel boxes, cabinets, switchboards and other products which this firm manufactures, together with a general growth in all departments, has made this move necessary. This company has a reputation throughout the entire West as manufacturers of large switchboards and as having constructed some of the largest and most elaborate X-ray coils in the country; and is practically the only establishment in that territory which undertakes the construction of any kind of electrical, experimental or scientific apparatus generally supposed to be produced only in the extreme East. This was demonstrated by its pioneer work in wireless telegraphy, some of their apparatus having been in daily operation for the past six years on the Pacific Coast. In the new location, provision has been made for an electric garage and charging station, where it will also handle the agency for an electric automobile, storage batteries, etc. W. P. Carstarphen, Jr., is president and manager and D. M. Gray secretary and treasurer of the firm. L. M. McBride is retained in the capacity of assistant manager and engineer. The recent expansion makes it the largest exclusively electrical house in Denver.

INDUCTION MOTORS FOR GRINDING SHOPS.—Deer & Company, Moline, Ill., one of the largest manufacturers of plows and agricultural implements in the world, recently purchased a number of 20-hp and 30-hp, 60-cycle, 3-phase, 440-volt, Allis-Chalmers induction motors, for use in the grinding shop where the mould boards, shares and other plow parts are ground. The service to which these motors are to be applied is intermittent in character, and the application itself is something out of the ordinary. Each motor is arranged for a pulley on either end of the shaft, but the pulleys are left off and the shaft is extended by coupling to it a piece of shaft about 6 ft. long carrying pulley and having extra bearings. From each pulley is belted a grinding machine, each machine having two emery or carborundum wheels, as desired, for the special type of steel to be ground, making a total of four grinding wheels to each motor, allowing four men the service of one motor, which gives a group drive effect. The pieces of steel to be ground are laid on the frame, and the operator presses the steel against the wheel by lifting the frame up so the desired part of the steel can be ground. Thus there is a possibility of four men grinding at once, but rarely more than two wheels are working at once, because of time consumed in shifting the steel pieces on the frame so as to get them in position to be ground.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Company's instrument statement for the month of May and five months ended May 31 compares as follows:

May.	1907.	1906.	1905.	1904.
Gr. output	153,835	211,575	168,764	103,897
Returned	79,577	59,343	53,212	51,721
Net output	74,258	152,230	115,552	52,176
5 mo. gross output	777,743	944,614	777,065	508,372
Returned	453,870	303,362	231,115	203,046
5 mo. net output	323,873	641,252	545,950	305,326
Total outst.	7,431,709	6,339,510	5,026,514	4,084,843

This indicates a steady gain but well below that of 1905-6, which was abnormal as compared with 1904.

LONG DISTANCE OIL PUMPING.—An interesting installation will shortly be made in the San Joaquin Valley, Cal., when an oil-pumping plant 285 miles in length will be installed. The Southern Pacific Company have recently awarded to the George E. Dow Pumping Engine Company contract for this work. There will be twenty-four separate stations, and each station will be equipped with 750 horse-power of Edge Moor water tube boilers, built by the Edge Moor Iron Company, Edge Moor, Del. This will make the largest water tube boiler installation in the country for pumping oil. The Tracy Engineering Company, of Los Angeles and San Francisco, the Pacific Coast agents of the Edge Moor Company, will erect these boilers.

FUEL ECONOMIZER ORDERS.—The Boston Elevated Railway Company, Lincoln Power Station, Boston, Mass., and the Wood Worsted Mills, Lawrence, Mass., have recently placed repeat orders with the B. F. Sturtevant Company, of Boston, Mass. for their new metal-to-metal fuel economizers. In the case of the Boston Elevated Railway Company, a special form has been adopted to meet special requirements. The Syracuse Malleable Iron Works, Syracuse, N. Y.; Russia Cement Company, Anacortes, Wash.; Glen-Lowry Mfg. Company, Whitmore, S. C., and Union Light, Heat & Power Company, Fargo, N. D., are also installing fuel economizers with metal-to-metal joints manufactured by the B. F. Sturtevant Company.

CHICAGO SUBWAY.—Advices from Chicago state that all connections between the Illinois Tunnel and the various railroad freight houses will be completed within 90 days. President MacRoberts says that the mail service will be extended but no passenger service is in contemplation. Work is being pushed on the construction of switches to 30 additional business houses. Vice-president Collins says it will be completed within 30 days. Last month the company operated 28,000 trains. Facilities now permit of the operation of three times as many. The company operates 47 miles of underground track. Ultimately the system will cover 75 miles.

MOTORS IN PAINT FACTORY.—Some months ago the Wadsworth-Howland Company, of Chicago, large paint manufacturer, suffered the loss of its plant through fire, and instead of rebuilding upon the old site, purchased the paint works of George W. Pitkin & Company, then in process of building, and equipped it with Allis-Chalmers induction motors for driving the entire plant. The electric motor equipment comprises forty-odd motors ranging from 1 to 30 horse-power and aggregating over 300 horse-power. Four 30-hp motors operating at a speed of 900 r. p. m. drive six lead mixers, five 10-hp motors at 1200 r. p. m. drive the white lead and putty chasers, three of the number being used on tandem mills. Fourteen 5-hp machines are used on sampling mills and others for driving 20-in. water cooled mills. Nine 3-hp motors at 1800 r. p. m. drive water cooled mills, two 1-hp motors drive seamers, individual tanks and other auxiliary apparatus throughout the plant. All motors are belted to paint machinery built by Kaestner & Company, of Chicago, which in most cases run at slow speed, for which reason it is necessary to belt to each machine or group of machines through a countershaft in order to reduce the speed. An interesting test was made recently on this plant, when it was found that 86.75 lbs. of paint were ground with an expenditure of 24 kw-hours. With the millstones in better condition, this would have been improved considerably as to output, without any increase in energy consumption.

AUSTRALIAN MATERIAL.—*The Commonwealth of Australia Gazette* announces that tenders will be received at the office of the Deputy Postmaster-General, Sydney, up to Aug. 14, from persons desirous of contracting for the supply and delivery at the Departmental Stores, Sydney, of telegraph, telephone and electric-light material. The country in which the copper for copper wire items is produced must be stated. The *Gazette* also announces that tenders will be received at the office of the Deputy Postmaster-General, Perth, Australia, until Aug. 6, for the supply of a desiccating apparatus with motor-driven air pump for telephone cable work. Tenders must be accompanied by a deposit or receipt for deposit, lodged with the Deputy Postmaster-General in a state other than Western Australia, of 5 per cent on the amount thereof up to $5,000, or 2½ per cent on any further amount in excess of $5,000. In connection with the foregoing announcements it is stated that specifications and descriptions can be obtained at the Commonwealth Office in London, 72 Victoria Street, S. W., and that tenderers can arrange to have the preliminary deposits on their bids paid there.

CENTRAL ELECTRIFICATION.—Another important step was made in the electrification of the New York Central Railroad this week, in the complete abolition of steam at the Grand Central terminus for all its trains. The last ten steam locomotives were dropped July 1, and thus the whole Central terminal business is now handled electrically, marking a significant date in electric railway work on the large scale.

N. Y. EDISON PLANT.—Tenders for constructing the new plant of the Edison Electric Company on 201st Street, which is to be a duplicate of the plant on Fifty-Ninth Street, have been made, but no award is announced as yet. The plant will require upward of 8000 tons of structural steel, it is reported, which contract will be subsequently let by the general contractors.

Financial Intelligence.

THE WEEK IN WALL STREET.—Early in the week the stock market was dull, but became more active with general advances after the middle of the week. Good crop prospects, as well as an apparent ending of the gold-export movement, were largely responsible for this, while the market disregarded the advance of money rates at 7 @ 10 per cent on call as being a natural and temporary result of the enormous July 1 disbursements, which amount to over $180,000,000. The failure of the New York City bond sale to be fully subscribed for caused a break on Friday afternoon. Incidents of the week were scanty, but on the whole favorable. Rumors of a fresh bond issue by the United States Steel Corporation were emphatically denied. The favorable report for the year ending April 1, issued by the American Car & Foundry Company, attracted considerable attention. The decline in copper prices had but little effect on Amalgamated, but the Interborough stocks were again a weak feature in the face of the general improvement. All the other traction stocks and the electric list were more active and made substantial advances in many instances. In a general way the curb market showed a better tone, with twice as large a volume of business as during the previous week. Following are the closing quotations of July 2:

NEW YORK.

	June 25	July 2		June 25	July 2
Allis-Chalmers Co.	9⅞	10	General Electric	138	138
Allis-Chalmers Co. pfd.	28	29	Hudson River Tel.	—	—
Am. Dist. Tel.	—	—	Interborough Met. com.	16¼	16
American Locomotive	58	58⅜	Interborough Met. pfd.	47	43¾
Amer. Locomotive pfd.	103	105	Mackay Cos.	—	—
American Tel. & Cable.	75	75	Mackay Cos pfd.	—	—
American Tel. & Tel.	—	109	Marconi Tel.	—	—
Brooklyn Rapid Transit.	55¼	56	Metropolitan St. Ry.	—	*95
Electric Boat	33	33	N. Y. & N. J. Tel.	—	100
Electric Boat pfd.	80	80	Western Union Tel.	79½	79½
Electric Vehicle	—	—	Westinghouse com.	143¼	143
Electric Vehicle pfd.	—	—	Westinghouse pfd.	—	—

BOSTON

	June 25	July 2		June 25	July 2
American Tel. & Tel.	105	109	Mass. Elec. Ry. pfd.	57	—
Cumberland Telephone.	103¼	—	Mexican Telephone	*2¼	2⅛
Edison Elec. Illum.	205	214	New England Telep.	*110	110
General Electric	138	138¾	Western Tel. & Tel.	5	—
Mass. Elec. Ry.	16¼	—	West. Tel. & Tel. pfd.	*70	—

PHILADELPHIA.

	June 25	July 2		June 25	July 2
American Railways	48	48½	Phila. Electric	8	8⅜
Elec. Co. of America.	9⅝	9⅞	Phila. Rapid Transit.	23⅞	24¼
Elec. Storage Battery.	48¾	51	Phila. Traction	—	94
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	June 25	July 2		June 25	July 2
Chicago City Ry.	150	160	National Carbon	73	—
Chicago Edison	140	144	National Carbon pfd.	—	—
Chicago Subway	24	25¼	Union Traction	3⅛	3½
Chicago Tel. Co.	—	125	Union Traction pfd	17½	18
Metropolitan Elec. com.	23	23½			

*Asked.

PHILADELPHIA TRACTION LAW.—Mayor Reyburn, of Philadelphia, has signed the new ordinance whereby the city becomes a partner in the management of the Philadelphia Transit Company, and in 50 years will become sole owner of the entire traction system. Subsequently the City Councils elected two representatives on the board of directors of the Transit Company. The mayor also becomes a member of the board. Under the ordinance the city is to have half of all the company's profit over 6 per cent. The company must establish a sinking fund to extinguish its capital of $30,000,000 at the end of 50 years. It is required to call in unpaid capital and expend the whole amount in improvements. The city will have a right on any July 1 to take over the whole property upon six months' notice after paying the amount of its outstanding capital stock. This right is assignable. The ordinance to regulate passenger railways approved July 7, 1857, together with all other ordinances on this subject are repealed, but the city retains the right to make all rules and regulations relating to the operation and management of the company's lines necessary for public health and safety. For paving of streets and car licenses the company will pay an annual charge running from $500,000 in the beginning to $700,000 in the last 10 years of the contract. Other fixed payments are provided. The company cannot assume further leases or obligations or part with its property without the consent of the city. It cannot issue stock or bonds without the consent of the Councils. Councils may determine upon routes of new surface, elevated or subway lines, and if the company fails to accept the same within 90 days the city may offer the franchises to those who will undertake them. As a means of assuring payment of part earnings to the city, the controller is to have access to the company's books, accounts and vouchers to verify its financial statements by examination and report result to the Councils.

MR. SPEYER ON THE OUTLOOK.—At the opening of the Hampstead section of the London Underground "tube system" last week, a project in which American capital is largely interested, owing to the flotation here of $15,000,000 of the Underground 5 per cent notes through Speyer & Company, Sir Edgar Speyer, of the London banking house of Speyer Brothers, made an address containing the following remarks regarding the investment situation: "I alluded at the beginning of my remarks," said Sir Edgar, "to the depression and disturbance that prevail in the investment markets, and I must say that the want of sympathy for, not to say hostility to, private enterprise has had an unfavorable effect generally. While the main causes of this depression are what we may call natural causes, I cannot but agree with the view of that eminent financial authority, Lord Rothschild, that the talk of what is loosely termed Socialistic tendency has had a frightening result in many quarters. I consider these fears exaggerated and hardly warranted, but it should be remembered that there is a very narrow margin between fear and caution in business and that capital

is timid. I trust and believe that those in authority are fully alive to this danger, and will realize that in the financial situation as it exists all over the world it is imperative that all impressions of capital being threatened or not sufficiently protected should be dispelled."

DIVIDENDS.—Directors of the Detroit United Railway Company have declared a regular quarterly dividend of 1¼ per cent on the capital stock, payable Aug. 1. The Manchester Traction, Light & Power Company has declared a regular quarterly dividend of 1½ per cent, and an extra dividend of 1 per cent, payable July 15. The Nebraska Telephone Company has declared the regular quarterly dividend of 1½ per cent, payable July 10. Directors of the Mexican Telegraph Company have declared the regular quarterly dividend of 2½ per cent, payable July 16. Dividends have been declared by the United States Telephone, regular quarterly, ¾ of 1 per cent on the common and ½ of 1 per cent on the preferred, payable July 10, and the Havana Electric Company quarterly 1¼ per cent on the preferred. The National Light, Heat & Power Company has declared a regular quarterly dividend of 1¼ per cent on the preferred stock, payable July 1. The New York & New Jersey Telephone Company has declared a regular quarterly dividend of 1¾ per cent on the capital stock, payable July 15. The United Traction & Electric Company of New Jersey has declared a dividend of 1¼ per cent on the capital stock, payable July 1. The directors of the Multiphone Operating Company have declared the regular monthly dividend of 1 per cent, payable July 1. The East St. Louis & Suburban Company has declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable July 15. The board of directors of the Havana Electric Railway Company has declared a dividend of 1½ per cent for the quarter ended June 30. The Cincinnati, Newport & Covington Traction & Light Company has declared a dividend of ¾ of 1 per cent on the common and 1⅛ per cent on the preferred stock, payable July 15. The Newburyport, Mass., Citizens' Street Railway Company has declared a dividend of 2½ per cent, payable July 1. The Dayton, Ohio, City Railway has declared the regular quarterly dividend of 1¾ per cent on the common stock and 1½ per cent on the preferred, payable July 1. The Cleveland, Ohio, Electric Railway Company has declared the regular quarterly dividend of ¾ of 1 per cent, payable July 1. The Forest City Railway Company, of Cleveland, Ohio, has declared the regular quarterly dividend of 1½ per cent, payable July 1. The Northampton, Mass., Street Railway Company has declared a semi-annual dividend of 3 per cent, payable July 1. At the meeting of the Hall Signal Company, the dividend of 1 per cent and ¼ per cent extra on the common stock was declared, payable July 1. The directors of the Philadelphia Company have declared the regular quarterly dividend of 1½ per cent on the common stock, payable Aug. 1.

WESTERN UNION.—With regard to the recent decline of Western Union Telegraph 7 or 8 points to 78½, and the issue of bonds, the *Wall Street Journal* says: "The surplus available for dividends after deducting bond interest is equal to 5.16 per cent earned on the $97,340,600 capital stock outstanding. Out of this, the company is paying dividends at the rate of 5 per cent, leaving a surplus for the year which is equal to only .16 per cent on the stock, a very close margin. Some comment has been caused by the issuance of $10,000,000 of additional bonds with a consequent addition of $400,000 per year to the fixed charges when the balance sheet shows a surplus of $17,019,898. Such action was justified, however, because the surplus funds have been invested in new plant and extensions and new funds were needed in order to restore the surplus account to its proper relation to the other items in the balance sheet. The capitalization of tangible property such as these additions was entirely proper. An avenue of explanation of the earnings and future probabilities of the company may be followed in the comparative figures, given below, which are practically self-explanatory:

	Receipts.	Expenditures.	Net.
1906	$30,675,655	$23,605,071	$7,070,582
1905	29,033,635	21,845,570	7,188,064
1904	29,249,390	21,361,915	7,887,474
1903	29,167,686	20,953,215	8,214,471
1902	28,073,095	20,780,766	7,292,328

From the foregoing figures it will be seen that as the company's business has increased during the last five years with but one exception, the ratio of operating expenses to gross income has been greater each year and the balance available for charges and disbursements to stockholders has gradually decreased.

WESTINGHOUSE ACTIVITY.—The statement of income of the Westinghouse Electric & Manufacturing Company and its subsidiary concerns for April and May, the first two months of the company's current fiscal year, seem to indicate that unless there is a material falling off in business the company will establish a new high record in earnings, orders received, collections and production for the 12 months ending March 31, 1908. The manufacturing profits in April and May aggregated $1,248,786, and miscellaneous income $155,837, making the total income $1,404,623, which was at the rate of $8,427,738 a year. The following table, from the *Wall Street Journal*, gives the orders, shipments and collections of the Westinghouse Electric & Manufacturing Company over a series of years, and the possible shipments and orders in the current fiscal year, based on shipments valued at $3,880,000 in May:

	Orders.	Shipments.	Collection.
1907-8	$49,000,000	$46,560,000	$46,000,000
1906-7	34,170,647	29,189,844	30,549,894
1905-6	24,938,631	21,059,249	21,649,184
1904-5	16,570,617	18,069,862	20,546,478
1903-4	18,509,054	21,122,646	21,872,228
1902-3	19,522,144	21,490,708	20,445,443
1901-2	17,927,339	17,804,182	16,947,774
Totals	$180,638,432	$175,296,491	$178,111,001

The current year figures are based on May shipments. A favorable feature of the Westinghouse Electric's showing in April and May, was the increase in its manufacturing profits on shipments. For example, shipments in May aggregated $3,880,000, and the total net earnings, in that month reached $720,713. Its earnings were equivalent to something like 18½ per cent of shipments in that month.

MEXICAN TELEGRAPH.—The statement of estimated earnings of the Mexican Telegraph Company for the quarter ending June 30, 1907, shows only a small increase in gross earnings and a decrease in net caused by the estimated increase in operating expenses. According to the estimated figures, the gross earnings this quarter will show an increase of approximately 1.1 per cent, while net earnings will show a decrease of 1.3 per cent, the decrease in the latter being caused by the estimated increase in operating expenses, amounting to 14.2 per cent. The item of total income shows an increase of 1.2 per cent, while the quarter's surplus is estimated to be only .05 per cent greater than that of the like quarter of 1906. The total surplus at the end of the quarter will be $212,999, or 9.7 per cent less than the same quarter of last year. Part of the surplus decreases was caused by the increased payments to the Mexican government on concessions. The showing of gross and net earnings of this quarter does not compare very favorably with the same quarter of previous years. In 1905 gross increased $16,500 and net $12,500 and in 1906 gross and net increased approximately $34,500, while for this quarter the estimated increases are only $2,000 each.

CENTRAL & SOUTH AMERICAN TELEGRAPH.—The statement of the Central & South American Telegraph Company for the quarter ending June 30, 1907, partly estimated, reveals a satisfactory increase in gross and net earnings, but the operating expenses as estimated by the company show a large increase, greater in proportion than either gross or net. Gross earnings are estimated to increase 11.9 per cent for the quarter, but the increase of 23.3 per cent in estimated operating expenses makes the showing of net earnings not quite so good as gross, being 6.9 per cent. While the item of total income is increased 6.3 per cent, the quarter's surplus shows a decrease of 9.5 per cent, when compared with the surplus for the same quarter last year. The total surplus as of June 30, compared with the surplus at the same time last year will show an increase of $490,577, or 29.6 per cent. The increase of 25 per cent in the item of dividend requirements is caused by the payment of dividends on the $2,000,000 of stock which was issued on June 1 to stockholders as a 25 per cent dividend.

J. G. WHITE & COMPANY, of London, England, have just presented their seventh report, up to Feb. 28, 1907. It shows a profit for the year of £38,378, the available balance being £47,811. When the year closed the value of contracts on hand was in excess of £1,500,000, and the business included work in Buenos Ayres, Para, Montevideo, Caracas and Bombay. There was carried forward a sum of £18,311, with £20,000 to reserve account; while £9,500 was paid out in dividends and bonus. The allied Waring White Building Company is showing progress.

BELL TELEPHONE CAPITAL.—Advices from Boston are to the effect that the success of the American Telephone & Telegraph Company stock subscription has far exceeded the estimates of the management. Final figures will, of course, not be ready for several days, but enough is known at present to make it certain that less than $2,000,000 of the entire $22,000,000 of new stock will remain unsubscribed for. In the early days of the subscription the opinion was freely expressed by many students of the telephone situation that the company could not possibly sell at this time more than $5,000,000 to $10,000,000 new stock. A telephone official says: "The splendid success of the new stock issue proves one thing—that in the midst of a period of universal depression in the security markets of the world the stockholders of the American Telephone & Telegraph Company may be counted upon to support the company by taking a new issue of stock. If the New England investors will loyally support the company at such a time as the present, it is almost self-evident that they will at other seasons when capital is flowing more freely into investment channels." One of the most important results of the new subscription has been the increase in the number of stockholders. Although it will be a week or two before the exact results are known, it is practically assured that the stockholders list now crosses the 20,000 mark. Last January the company had 18,194 stockholders. According to William W. Cook, general counsel for the Mackay Companies, that organization exercised its right to the full proportion of new stock of the American Telephone & Telegraph Company, which will be allotted to it according to its present holdings. As the Mackay Companies hold approximately 70,000 shares, their proportion of new stock at the rate of one share to each six shares already held will be about 11,600 shares, and would entail the payment of $1,160,000.

NEW JERSEY PUBLIC SERVICE.—Last week a 4 per cent dividend, payable quarterly, was declared by the board of directors of the Public Service Corporation of New Jersey. It was the first time the company has taken such action since its organization, May 9, 1903. At a meeting of the directors of the United Electric Company, a subsidiary concern, previous to the meeting of the Public Service board, a special 5 per cent dividend out of the accumulated surplus was declared. The United Electric Company was organized June 1, 1899, but never paid a dividend before. The authorized capital stock of the Public Service Corporation is $25,000,000. Of this amount $12,250,000 has been issued. Besides this there are outstanding in 5 per cent convertible notes $6,250,000, on which two more instalments of 10 per cent each are due from their holders. It is mandatory upon the corporation to convert these notes into stock. When the Public Service Corporation was formed it took over gas, electric lighting and trolley corporations whose outstanding stock aggregated approximately to $60,000,000. Under the terms of the merger this capitalization was lowered to $20,200,000, certificates being issued in exchange for the stocks in ratios as follows: United Electric Company, 30 per cent; Orange & Passaic Valley, 30 per cent; Elizabeth, Plainfield & Trenton, 30 per cent; Jersey City, Hoboken & Paterson, 35 per cent, and North Jersey Street Railway, 40 per cent. The interest charge on these certificates under the merger agreement was to begin at 1 per cent and rise by degrees to a maximum of 6 per cent. Mr. Thomas N. McCarter, president of the Public Service Corporation, after the meeting said that the United Electric dividend represents a division of the present cash assets of the company available for distribution, and as no dividend has heretofore been declared it is at the rate of ⅚ of 1 per cent for 8 years of the company's existence.

STATE LINE TELEPHONE COMPANY.—The filing of a collateral trust mortgage for $5,000,000 by the State Line Telephone Company made to the Commercial Trust Company of New Jersey against which $1,000,000 of 5 per cent bonds will be immediately issued is seemingly the first step of that company to provide funds to finance a fight for an entrance into New York City. The company is one of a group of independent companies which are building lines in New York State and also in New Jersey to compete with the various Bell companies. It is stated that it already has a service as far south as Peekskill and the proceeds of these bonds will enable it to extend its system. The Great Eastern Telephone Company, which is affiliated with this company, is now an applicant for a franchise in New York City, claiming rights under a franchise granted the New York Electric Lines Company in 1883. The corporation counsel has reported adversely, however, on the validity of the franchise and the courts have refused to grant a writ compelling the city authorities to give permission to open the streets for the purpose of building subways for its wires.

WESTINGHOUSE EARNINGS.—The consolidated and condensed statement of income for the Westinghouse Electric & Manufacturing Company and its subsidiary companies for the first two months (April and May) of the present fiscal year is as follows:

Manufacturing profit	$1,248,786	
Miscellaneous income	155,837	
Total income		$1,404,624
Less interest on bonds and debenture certificates, miscellaneous interest, depreciations, etc.		584,800
Net credit to surplus		$819,824

The management, under the direction of E. M. Herr, first vice-president, has been making radical changes in manufacturing methods having for their object an increase in output, a decreased percentage in amount of material carried in stock and in process of manufacture, and a general improvement in quality of apparatus. All sales of the company are substantially for cash and monthly collections are substantially equal to the amount of the shipments.

GOVERNMENT REVENUES.—According to official statistics from Washington the fiscal year of the Government has closed with a surplus of substantially $87,000,000, one of the largest net balances ever shown. In the fiscal year 1902 there was a surplus of $91,287,275, but that was the largest since 1890. In the year just closed the income from the various sources of revenue was $369,306,133 and expenditures $578,376,709, as compared with receipts of $589,574,286 for the last fiscal year, and expenditures of $568,784,790, the surplus in that year being $25,669,322. There has been a tremendous increase in receipts in the year just closing, while the expenditures have been only about $10,000,000 in excess of last year. The largest increase in receipts has been from customs, although internal revenue has shown a big gain. The receipts from the different sources this fiscal year have been as follows: Customs, $333,230,126; internal revenue, $270,309,388; miscellaneous, $61,766,619.

NEW YORK BONDS are not wanted in these days of municipal plants and ownership. Last week the city offered $29,000,000 of 4 per cents and had takers for less than $2,000,000, on which the highest offer for small lots was 101.50. The city offered $20,000,000 of corporate stock for various municipal purposes, $5,000,000 of corporate stock for water supply, $1,500,000 of stock for rapid transit, and $500,000 of stock for the public library. All these issues were for the 50-year term. There was also an issue of $2,000,000 of assessment bonds, payable in 1917. There were received 62 bids from 56 bidders. The total amount of bids received was $2,121,840. The average price of the 1957 stock was 100.091, making the income basis about 3.994 per cent. The average price of the 1917 bonds was 100.02, and the income basis of the latter about 3.997 per cent. The lowest price offered was par and the highest 101.50.

BOSTON EDISON PROSPERITY.—The Edison Electric Illuminating Company declared last week a regular quarterly dividend of 2½ per cent and an extra dividend of 1 per cent. President Edgar said: "By reducing its prices in the last year the company has reduced the bills of its customers by $200,000. Notwithstanding this it finds itself able to pay an extra dividend of 1 per cent, thus adopting in a tentative way the general principles involved in the operation of the so-called sliding scale."

ILLINOIS CONSOLIDATION.—The St. Clair County (Ill.) Gas & Electric Company recently formed by the consolidation of the Belleville Gas & Electric Company and East St. Louis Gas & Electric Company, and controlled by the American Gas Company of Philadelphia, has issued $1,200,000 1st consolidated 5 per cent gold bonds. The capital stock is $3,350,000 common and $150,000 preferred.

LARGE TRACTION MORTGAGE.—A mortgage of the properties of the Chicago City Railway Company was placed on record this week calling for the issue of bonds for $10,000,000, due in 20 years, at 5 per cent interest. The money is for use in the general improvement of the company.

CHICAGO EDISON GROWTH.—Special Chicago financial despatches state that the details of the plan to consolidate the Chicago Edison and the Commonwealth Electric companies will be worked out before the adjourned annual meetings of both companies July 15. Directors believe that they can go ahead without the consent of the city, but as the merger proposition became involved a year ago with the question of rates, it has been decided to go before the council again. The so-called Chicago Subway-Chicago Edison deal is regarded by the Edison management as though it never existed. At no time was the management in favor of it or willing to admit its existence as a tangible development. Chicago Edison's franchise expires in 1912, while the Commonwealth's franchise runs to 1947. The Commonwealth in case of merger would naturally take over the Edison properties. All the Commonwealth stock is held for the benefit of the Edison stockholders. Short term notes recently issued by the Edison were guaranteed by the Commonwealth. When the Commonwealth franchise was taken over a contract was entered into by which the Chicago Edison agreed to purchase enough energy from the Commonwealth to pay the interest on its bonds. Since then the Commonwealth has outgrown the original company in importance, but it still sells it energy as at the beginning. A consolidation would mean little in the actual affairs of the two concerns. Combining the assets and liabilities of the two, the capital stock is shown to be $23,614,115. Should the Edison increase its capital to $15,000,000, the consolidated company's capital stock would be $25,000,000. Under the new municipal régime all such public utility systems stand better financially, and if well run like the Chicago Edison will enjoy better treatment than heretofore. The Chicago Edison board is composed of the following: Henry A. Blair, Edward L. Brewster, Samuel Insull, Robert T. Lincoln, Joseph Leiter, John J. Mitchell, Erskine M. Phelps, A. A. Sprague, Lambert Tree. Under the Insull régime the Chicago Edison system has seen wonderful but solid growth.

UTAH-NEVADA POWER.—Articles of incorporation have been filed with the Colorado secretary of state for the Utah-Nevada Power Company with a capital of $7,500,000, by Orlando B. Willcox, Horace G. Lunt, D. B. Ellis, L. B. Johnson, George A. H. Fraser, W. A. Reef, Charles I. Hawthorne and J. C. Darling. The company, of which note has already been made in these columns, is an auxiliary of the Central Colorado Power Company, which has a capital of $22,000,000. Behind the parent company are Former Governor Myron T. Herrick, of Ohio; Thomas F. Walsh, David Moffat and other Colorado capitalists. Its purpose is the construction of one of the largest power plants in the world in the Gore cañon, Colorado, on the line of the Moffat road, supplemented by similar plants on a smaller scale near Glenwood Springs and down in the Gunnison. Another auxiliary power plant is projected in Boulder County and known as the Eastern Colorado Power Company, with practically the same people behind it. The purpose of the parent concern is to develop enough energy to furnish electric power not only to most of the mining districts of Colorado, but also to many of its chief cities for street railways, lights and other commercial enterprises. The organization of the Utah-Nevada Company is intended to furnish electric power to the mining districts, cities and towns in Utah, Nevada and Idaho, as well as in Colorado. The plan is to cover as much territory in the contiguous states as will be feasible and profitable. Seventy-five thousand shares of stock will be issued at $100 a share, 25,000 of which will be preferred and 50,000 common. Six per cent cumulative dividends will be guaranteed annually on the preferred stock.

CINCINNATI LEASES.—In order to comply with the requirements of the Ohio laws in the lease of the Cincinnati, Newport & Covington Light & Traction Company, those interested in the Columbia Company will shortly incorporate the Columbia Gas & Electric Company, of Ohio. The lease will be made to this company and assigned to the Columbia Company, of West Virginia. The lease is for 99 years and will be dated April 1, 1907. The lessee agrees to guarantee the interest on all outstanding bonds, the 4½ per cent dividend on the preferred stock and a graduated scale on the common stock, beginning with 3½ per cent the first year and increasing to 6 per cent in the sixth year, which is the rate to be paid thereafter. The first quarterly dividend on the common stock will be paid on July 15. Holders of ten shares or more of the original railroad stock may subscribe for bonds of the Columbia Company on the basis of 90 per cent of the face value of such bonds to the extent of 50 per cent of their holdings and the same amount of common stock as a bonus. Those who have less than ten shares of stock may subscribe for one $500 bond, paying for it $450 and receiving $500 stock as a bonus. A statement to the stockholders shows that the bond issue of $25,000,000 of the Columbia Company will be used for the following purposes: $9,000,000 for the purchase of the Cleveland gas properties; $6,000,000 to build a pipe line to Cleveland; $6,500,000 to build a pipe line to Cincinnati; $1,000,000 to acquire gas field in West Virginia and $2,500,000 to provide a guaranty fund and take care of future developments.

INDEPENDENT TELEPHONY.—A special dispatch from Rochester, N. Y., gives the following news as to negotiations which still seem to be all in the air: "All negotiations with the St. Louis people for the purchase of the United States Independent Telephone Company for $6,000,000 were declared off this afternoon without result, and the telephone company managers state that the company will be reorganized by its present bond and stock holders. Edward F. Geltra and E. A. Faust, of St. Louis, arrived here from New York for a conference with the option committee of the telephone company. It is understood they were negotiating with New York financiers, represented by the Phenix National Bank, to take over the properties. The St. Louis men told the committee that their deal for taking an option on the properties of the United States Independent Telephone Company at a sale price of $6,000,000 must be declared off."

TELEPHONE EARNINGS.—The Cumberland Telephone & Telegraph Company shows gross earnings for May of $477,753, and a net of $151,534, an increase of $6,004. The United States Telephone shows gross for April of $34,927, and a net of $22,715, a gain of $579. The Cuyahoga Telephone Company's report for the year ended Dec. 31, 1906, compares as follows:

	1906.	1905.	
Gross	$776,156	$587,487 Inc.	$128,669
Expenses	388,916	367,930 Inc.	20,986
Net	$307,240	$191,877 Inc.	$115,363
Charges	261,104	175,863 Inc.	85,241
Surplus	$46,136	$16,014 Inc.	$30,122

ELECTRIC LIGHT EARNINGS.—Several of the systems operated by Stone & Webster report good April earnings. The Lowell Electric Light Corporation shows $24,727 or $3,337 better than in 1906. The Minneapolis General Electric Company reports $71,705, a gain of $9,568. The Edison Electric system of Brockton reports $14,380, a gain of $1,442. The Houghton County Electric Light Company of Houghton, Mich., reports $19,241, an increase of $2,004. A decline is shown by the Cape Breton Electric Company Line, the earnings being $16,880, a falling off to the extent of $1,498, but for the twelve months there was an increase of $14,767.

TOLEDO CONSOLIDATION.—The directors of the Toledo (Ohio) Railways & Light Company have approved the contract by which the company is to take over the properties of the Toledo Gas, Electric & Heating Company. The company guarantees $2,200,000 of $2,500,000 bond issue of the lighting company. The exchange of stock is on the basis of three shares of Toledo Railway & Light for four shares of the lighting stock. The directors authorized an increase of the capital stock of the company from $12,000,000 to $15,000,000 to take care of the payment for the gas companies.

ALLIS-CHALMERS ORDERS.—The recent cry of "dull times" finds no echo in the business of Allis-Chalmers Company, which continues to show a steady gain. During the month of May this company shipped from its works 553 cars of machinery, which was a gain of 20 cars over the record established for April. In April, the aggregate weight of shipments was 21,680,847 lbs., while for the month of May the figure had risen to 23,772,242 lbs., making a total by weight for the two months of 45,463,089 lbs.

WEST INDIA ELECTRIC.—The West India Electric Company, which operates the electric railway and lighting company, Kingston, Jamaica, with Canadian capital, for the year ending Dec. 31 shows gross earnings of $165,776, an increase of $266,013, while the net earnings totaled $87,251, an increase of $17,623. The total loss sustained by the company by the earthquake in Kingston was $15,000. This is the best year the company has ever had.

GENERAL NEWS

Construction News.

GREENSBORO, ALA.—The Greensboro Water & Light Company is planning to establish an all-night service and install meters. James E. Webb, Jr., is manager.

HUNTSVILLE, ALA.—Plans have been completed for doubling the capacity of the power plant of the Huntsville Railway, Light & Power Company at a cost of from $30,000 to $35,000.

UNIONTOWN, ALA.—S. T. Townsend, superintendent of the municipal electric light and water plant, writes that the city is contemplating installing meters next year, and will also install larger hydraulic pumps.

BISBEE, ARIZ.—The City Council has granted a franchise to the Warren Company to operate a street railway through certain streets of the city.

PINE BLUFF, ARK.—The Pine Bluff Water & Light Company has decided to build a new electric light and water works plant on West Fourth Avenue.

LOS ANGELES, CAL.—The Los Angeles-Pacific Railway Company has purchased the franchise for an electric railway from Fourth and Western Avenues, on Western Avenue, to the city limits of Hollywood, for which it paid the sum of $100. The company is also applying for a franchise within the city of Hollywood, which will be a continuation of this proposed line.

LOYALTON, CAL.—Henry Goering is making investigations in the Beckwith section in connection with the erection of an electric plant for the purpose of furnishing this valley with electricity for light and power. The plans of the company also include an electric railway in the project later on.

MAGALIA, CAL.—The Steifer Mining Company is making arrangements to furnish electricity for operating its mines. The company is planning to erect a plant on the Feather River, about 1¼ miles above the Magalia bridge, and about 100 feet below the mouth of Empire Gulch. The plant will have a capacity of about 600 horse-power, and it is expected to have it in operation about Aug. 1. Machinery for the plant has already been purchased.

MODESTO, CAL.—The St. Elmo Construction Company, of Turlock, has applied to the Board of Supervisors for a franchise to erect poles and wires for the purpose of transmitting electricity in this town.

RED BLUFF, CAL.—H. H. and J. J. Hammer have filed notices of their intention to take 10,000 inches of water from the South Fork of the Cottonwood Creek, near the mouth of Maple Creek. The water will be used for mechanical purposes and to generate electricity.

SAN FRANCISCO, CAL.—The General Electric Power Company of California will hold a stockholders' meeting in San Francisco on Aug. 14, to consider and act upon a proposition to increase the capital stock from $1,000,000 to $9,000,000. Guy C. Calden is secretary of the company.

DENVER, COL.—The Silver State Laundry will erect a power house on Walnut Street at a cost of about $2,000.

DANBURY, CONN.—The Danbury & Bethel Gas & Electric Light Company has recently received a 750-kw turbo-generator set which will soon be placed in the power house on Pahquioque Avenue, and arrangements are being made for the purchase of a second generator. Two new 300-hp boilers will be soon installed. Two additional boilers will be purchased, making four in all. The boiler house will have to be enlarged to make room for the two new boilers.

NEW LONDON, CONN.—The State Legislature has passed the bill allowing the Groton & Stonington Street Railway Company permission to furnish electricity for power purposes.

STAMFORD, CONN.—The Stamford Gas & Electric Company is now installing a 650-kw, three-phase alternator, direct connected to a Bass engine in its plant. R. Crawford is manager.

TORRINGTON, CONN.—Extensive improvements and additions are being made to the plant of the Torrington Electric Light Company. A 300-kw turbo-generator set and also a 300-kw General Electric belted type generator is being installed. The system is being changed to 2200-volt, 60 cycles. C. E. Smith is manager.

WINSTED, CONN.—The Winsted Gas Company is contemplating increasing its power plant and will install two 100-kw Curtis steam turbines and 250-hp boilers, and will also change the system to 60 cycles. Henry Skinner is manager.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts until July 16 next to furnish supplies at the navy yards as follows: League Island, Pa., schedule 59, electrical conductor and conduit; New Orleans, La., schedule 63, electrical supplies, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster General, U. S. N.

COLUMBUS, GA.—Extensive surveys are being made along the Chattahoochee River between Columbus and West Point. The first development will be at Clapp's factory just north of Columbus. The company already has two power plants in operation.

EMMETT, IDA.—The Ox Bow Power Company has purchased the electric lighting plant of the Emmett Power & Water Company.

ALTON, ILL.—The Alton, Jacksonville & Peoria Railway Company will soon establish an electric railway service from Alton to Godfrey. Electricity for operating the road will be furnished by the Alton, Granite & St. Louis Traction Company until the company can build its own power house.

BLOOMINGTON, ILL.—Bids will be received until July 9 by Harry E. Rhoads, city clerk, for reconstructing the electric light plant. There will be required one 350-kw generator, 400 series alternating current, 6.6-amp. arc lamps, with regulators and transformers; one surface condenser, with air and circulation pumps; also one smaller direct connected unit, consisting of simple automatic engine and 60-kw generator. A. T. Maltby, 803 Great Northern Building, Chicago, is consulting engineer.

CHICAGO, ILL.—The Chicago Telephone Company is contemplating the construction of an exchange building at 87 and 89 Franklin Street, to cost about $300,000.

CORNELL, ILL.—M. J. Rhodes, owner and manager of the Cornell electric light plant, writes that he is now erecting a new building, and contemplates changing the system from 125 to 60 cycles, and will also install an exhaust steam heating system this season.

KILBOURNE, ILL.—E. H. Parker has decided to establish an electric light plant in this village.

LEMONT, ILL.—The Village Board of Trustees is considering the proposition of purchasing the electric plant of the Lemont Electric Light & Power Company with the purpose of operating it as a municipal plant.

ARGOS, IND.—A new 100-kw Fairbanks & Morse alternator is now being installed in the city electric light plant. A. A. Yarick is manager.

CORYDON, IND.—The Corydon Light, Water & Ice Company will install a new engine and dynamo in its plant this fall.

DANVILLE, IND.—The Town Council has granted a 25-year franchise to the Danville Light, Heat & Power Company.

FT. WAYNE, IND.—It is reported that all bids opened on June 24 by the Board of Public Works for the construction of a municipal electric light and power plant have been rejected, and new bids will be received. Owen Ford, of St. Louis, Mo., is the consulting engineer.

GOSHEN, IND.—The Hawks Electric Company is preparing to erect a plant on the west bank of the canal at a cost of $25,000.

GOSHEN, IND.—The City Council is considering the proposition of adding new equipment to the municipal electric lighting plant.

KOKOMO, IND.—The Kokomo, Marion & Western Traction Company will install a new 1000-kw turbo-generator set in its plant.

LAFAYETTE, IND.—The Lane-Pike Company, of this city, has secured the contract for an electric light plant for the Indiana State Soldiers' Home for about $10,000.

PETERSBURG, IND.—The Cumberland Telephone Company has decided that it would not pay the $500 and 2 per cent of its receipts annually demanded by the city, and will remove its poles by July 10.

WINCHESTER, IND.—The Citizens' Water & Light Company is planning to change its system from direct to alternating current, and will need 1500 incandescent lamps, two 500-light transformers and one 300-light transformer.

ATOKA, I. T.—The Atoka Light & Power Company is contemplating installing a street lighting arc circuit, establishing a day service and making general improvements to its service. L. B. Griffing is manager.

DUNCAN, I. T.—The Duncan Light & Power Company is contemplating installing before fall an alternator of 75-kw capacity, and will also install an ice plant.

MUSKOGEE, I. T.—An electrical plant will be installed in the basement of the new Barnes Building.

ALBIA, IA.—The Albia Electric Light & Power Company will increase the capacity of its plant to furnish electricity for street railway service. An engine, generator and pump will be installed.

BURLINGTON, IA.—The Burlington & Bonaparte Interurban Electric Railway Company has filed articles of incorporation with the Secretary of State with a capital stock of $10,000 for the purpose of constructing an electric railway from Burlington to Bonaparte via West Point, a distance of about 38 miles. The officers of the company are: J. A. Johnson, of Bonaparte, president; John Blual, of Burlington, vice-president; H. H. Meeke, of Bonaparte, secretary and T. L. Lampe, of Burlington, treasurer. Preliminary surveys have been made and work on construction of the road will begin at an early date.

DAVENPORT, IA.—The Davenport & Suburban Railway Company and the Tri-City Railway Company have been consolidated. The first named company has been purchased by the latter for the sum of $1,000,000, to be paid in stock of the Tri-City Railway Company. The directors of the Tri-City Railway Company have voted to increase the capital stock from $1,500,000 to $2,500,000 to be used to take over the Davenport & Surburban line.

DES MOINES, IA.—Preliminary steps have been taken to increase the lighting facilities in the business section of the city.

MANCHESTER, IA.—Plans are being made to install a new 80 to 100-hp horizontal return flue boiler in the power house of the E. W. Hoag electric light and power plant. Estimates are now being received.

MASON CITY, IA.—The People's Gas & Electric Company will soon place a contract for a 500-kw generator direct connected to a 26 x 48 Corliss engine. The company is planning to furnish after Aug. 1 a three-phase power circuit and an alternating-current day service in addition to the direct-current day service which it now furnishes. The company has secured several contracts to furnish electricity for power purposes. A. W. Zahm is manager.

OSKALOOSA, IA.—The Oskaloosa Traction & Light Company is planning to increase the capacity of its plant and will purchase a 500-hp engine, a 300-kw, three-phase, 60-cycle alternator, and a 200-kw railway generator and to increase station equipment.

SIOUX RAPIDS, IA.—The citizens are considering the proposition of installing storage batteries in the municipal electric light plant.

ARGENTA, KAN.—The Argenta Light & Power Company expects to install a commercial incandescent and arc lamp service by 1908, and also to furnish electricity for operating a street railway line which is now under construction.

JEWELL CITY, KAN.—The Jewell Milling Company is making improvements to the street lighting service, and is installing 53 16-cp street series incandescent lamps. A. G. Blankenship is manager.

MARYSVILLE, KAN.—Extensive improvements are being made to the plant and system of the Marysville Light, Power & Water Company. The Brush arc machine and Thomson-Houston exciter have been discarded, and replaced by a 75-kw, 2200-volt, 60-cycle Westinghouse generator. Two Ball engines, of 110 and 125 hp. respectively, and a 20-hp motor to operate a triplex pump are also being installed. Work on the plant will be completed in about 30 days. G. D. Meyers is manager.

TOPEKA, KAN.—The Water Works trustees are contemplating installing an electric light plant at the pumping station.

DE QUINCY, LA.—C. H. Jenks, of Fayette, Miss., has been engaged as engineer for the proposed water works and electric light plant. Nothing definite has yet been done.

JEANERETTE, LA.—Edward C. Stokes, owner of the Jeanerette electric light plant, writes that he is contemplating adding a Corliss engine direct connected to a 100-kw Bullock generator to his plant.

BALTIMORE, MD.—The stockholders of the Baltimore Electric Company have authorized an issue of $1,000,000 in capital stock, the proceeds to be used in developing the electric business of the company.

BALTIMORE, MD.—The United Railways Company has closed a contract with the McCall Ferry Power Company to supply electricity to operate its system from the Susquehanna River plant. The contract calls for 10,000 kilowatts. The power will not be available until September, 1908. The Consolidated Gas, Electric Light & Power Company recently made a contract with the McCall Ferry Power Company for exclusive use in this territory of all the electrical energy of the company with the exception of that required by the United Railways Company.

HOLYOKE, MASS.—The Holyoke Street Railway Company and the Hampshire Street Railway have applied to the State Railroad Commissioners for approval of sale of the Hampshire Company to the Holyoke company, and for an increase in the capital stock of the Holyoke Company by 600 shares, par value $60,000.

BERRIEN SPRINGS, MICH.—Work has commenced on the $1,000,000 dam across the St. Joseph River at Pardee Island to furnish power for the Berrien Springs Power & Electric Company. The dam will be 21 feet high and 400 feet long.

CHARLOTTE, MICH.—The Commonwealth Power Company is contemplating extending its lines to this place, and the line will probably be carried through to Bellevue, where the company will furnish electricity for light and power in that city.

GALESBURG, MICH.—A private lighting plant is being installed at the Kalamazoo County farm and electricity to operate the plant will be secured from the Commonwealth Power Company.

HANCOCK, MICH.—The Common Council has decided that it is better to pay the Houghton County Electric Light Company $80 per street lamp per year than to invest $33,000 in a municipal lighting plant and has made a contract with the company for five years.

HOUGHTON, MICH.—We are informed that Prof. O. P. Hood, of Houghton, has completed plans for the power house and service tunnel for the Michigan College of Mines and bids for same will be received on July 11. The cost of plant is estimated at $43,000.

MASON, MICH.—A bill has passed the State Legislature enabling the city to purchase electricity from the Commonwealth Power Company to operate the municipal electric lighting system. The municipal plant is in need of repairs, and if kept in operation will need new machinery at once. Some action will probably be taken soon by the City Council, and the proposition of purchasing electrical energy from the Commonwealth Company will probably be submitted to a vote of the people.

MT. PLEASANT, MICH.—Work has commenced on the construction of the dams across the Chippewa River five miles east of Mt. Pleasant, to supply power for an electric plant in Shepherd, nine miles south of this place. C. C. Field, of Shepherd, is interested in the project.

PAW PAW, MICH.—The contract for constructing a hydro-electric power plant and dam on Paw Paw River and certain electric light and water works improvements has been awarded to the Falkenau Electrical Construction Company, of Chicago, Ill., for $34,964.

MARSHALL, MINN.—John R. Gray, city recorder, writes that J. B. Robertson, of St. Paul, has secured the contract for improving the electric light plant for $14,497.

HARLOWTON, MONT.—John K. Bright, president and manager of the Citizens' Electric Light & Power, of Lewistown, is considering the proposition of constructing an electric light plant in this place.

ST. LOUIS, MO.—B. H. Matthews and a number of residents of Wellston and Clayton are interested in a project to form a mutual electric lighting company consisting of the residents of Clayton, Maplewood, Greenwood, Wellston, Webster Grove, DeHodiamont and other thickly populated towns of St. Louis County.

UNIVERSITY PLACE, NEB.—R. E. Shelley, city clerk, writes that Baker & Early, of Lincoln, are preparing plans for an electric light plant, to cost about $15,000.

ELY, NEV.—J. B. Perrine and Major Fred E. Reed, owners of the Turin Falls power plant at Turin Falls, Idaho, recently visited this city and stated that they will extend a transmission line from their electrical system into this city and into other mining camps of White Pine County. If the present plans are carried out a line from the power plant at Turin Falls will soon be running into this city.

FALLON, NEV.—A contract has recently been closed with the United States Government by J. B. Daniel, general manager of the Nevada Wonder Mine and representative of the Brock syndicate, of Philadelphia, Pa., capitalists, for the right to operate the water power at the end of the Truckee-Carson irrigation canal, 12 miles from Fallon. The primary object of the company is to generate electrical power for its chlorination mill, work on which will commence at once. The company will also furnish the towns of Fallon, Fairview and Wonder with electricity, which will require the construction of a transmission line 75 miles long. The plans of the company also contemplate the immediate construction of an electric railway from Fallon, Fairview and Wonder.

YERINGTON, NEV.—Extensive improvements are being made to the Halachite property under the superintendency of O. H. Sonne. The company has ordered equipment, consisting of an air compressor, power drills, hoist, etc., which will soon be installed and placed in operation as soon as the transmission lines of the Truckee River General Electric Company are completed to this place.

ALBANY, N. Y.—The State Railroad Commission has granted the Suffolk Traction Company permission to construct a surface railroad in Suffolk County, from the town of Brookhaven to Babylon. The line will be 27 miles long.

ALBANY, N. Y.—The Buffalo, Genesee & Rochester Railway Company has been granted authority by the State Railway Commission to construct a double track street surface railroad 60 miles long from Depew to Rochester. The company has a capital stock of $7,500,000, and has been given consent to issue a mortgage for $5,000,000, the proceeds to be used for financing its construction.

AUBURN, N. Y.—The Auburn & Northern Electric Railroad has filed certificates of extension of its line from this city to Aurelius, a distance of about nine miles, and from there to the village of Seneca Falls, about two and one-half miles distant.

BABYLON, N. Y.—The Suffolk County Lighting Company has been granted a certificate of authority by the State Commission of Gas and Electricity to transact business in the town and village of Babylon.

BROOKLYN, N. Y.—The Board of Estimate has approved the franchise for the construction of an electric railway on Livingston Street.

BROOKLYN, N. Y.—Bids will be received until July 8 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric light wiring, fixtures, etc., in School 54, Borough of Brooklyn.

BUFFALO, N. Y.—It is reported that the Buffalo Southern Railway Company is contemplating the construction of a line from Buffalo to East Aurora, a distance of about 13 miles. Work on the road will be started this year.

CANANDAIGUA, N. Y.—It is stated that the Rochester & Eastern Rapid Railway Company will soon remove all high tension wires which are now within the limits of the corporation, and place them outside the corporate limits of the town.

CANANDAIGUA, N. Y.—The Ontario Light & Traction Company has placed contracts for the rebuilding of its electric light plant at Littleville, from which Canandaigua, Shortsville and Manchester are supplied with electricity. The present arc lighting system now in use will be replaced with luminous arc lamps.

CANTON, N. Y.—The Canton Electric Light & Power Company has been granted permission by the State Commission of Gas and Electricity to increase its capital stock from $18,000 to $38,000.

CHITTENANGO, N. Y.—The Board of Village Trustees has granted a franchise to the Syracuse & Chittenango Railway Company for a street railway system in the village.

HORNELL, N. Y.—The Hornell, Bath & Lake Keuka Railway Company has received authority from the State Board of Railroad Commissioners to build an electric railway from Hornell through Bath and Hammondsport to Branchport.

LOWVILLE, N. Y.—The State Commission of Gas and Electricity has granted authority to the Beaver River Light & Power Company to conduct business in Lowville; also to issue $40,000 in stock and $120,000 in bonds, and to acquire the stock of the Wetmore Electric Company now operating in this place. The village is taking steps to condemn the plant of the Wetmore Electric Company, intending to operate it as a municipal undertaking.

MT. VERNON, N. Y.—The State Commission of Gas and Electricity has ordered the Westchester Lighting Company to reduce the price of electricity furnished in Mt. Vernon from 20 cents to 13 cents per kw-hour, to take effect Sept. 1.

NEW YORK, N. Y.—The State Board of Railroad Commissioners has granted a certificate of necessity for a proposed electric railway to run on Van Alst Avenue, Astoria, from Flushing Avenue to the proposed new settlements of the Astoria Light, Heat & Power Company.

NIAGARA FALLS, N. Y.—William C. Thayer, of East Aurora, has secured the contract for installing the outside electric lighting system for the State Reservation for about $13,000.

ONEIDA, N. Y.—The Railroad Commissioners have approved of an increase of the capital stock of the Oneida Railway Company from $15,000 to $2,000,000. This increase is for the purpose of further construction and equipment and improvements already made, and which are now being made by the construction company for the Oneida Railway in connection with the electrification of the West Shore Railroad between Utica and Syracuse.

ONEONTA, N. Y.—The Hudson River Electric Power Company is contemplating extending its lines to this place. A representative has been in city recently making investigations with a view of applying for a franchise to furnish electricity for lighting and power purposes.

ORANGEBURG, N. Y.—The State Commission of Gas and Electricity has authorized the Rockland Light & Power Company to reduce the price of electricity furnished in Orangeburg from 20 cents to a maximum rate of 15 cents per kw-hour outside of incorporated villages, to take effect Sept. 1.

PATCHOGUE, N. Y.—The Suffolk Traction Company has been granted another franchise by the Town Board of Brookhaven and Highway Commissioners for a cross island route connecting Patchogue and Port Jefferson.

POTSDAM, N. Y.—The State Commission of Gas and Electricity has denied the application of the village of Potsdam to establish and operate an electric lighting system for commercial purposes.

RICHMOND, S. I., N. Y.—Bids will be received by C. B. J. Snyder, superintendent school buildings, New York City, until July 8, for installing electric equipment in addition to and alteration in School 13, Borough of Richmond.

ROME, N. Y.—The directors of the Rome City Railway Company have voted to increase the capital stock of the company from $150,000 to $500,000. A small part of this increase will be used to pay for improvements recently made and the balance held in the treasury to pay for extensions that are contemplated.

SARATOGA, N. Y.—The State Commission of Gas and Electricity has ordered a reduction in the price of electricity supplied by the Saratoga Gas, Electric Light and Power Company from 12½ cents per kw-hour to 8 cents per kw-hour, to take effect Sept. 1.

UTICA, N. Y.—It has been announced that the Utica & Mohawk Valley Railway Company will soon commence work of electrifying the Deerfield horse line, a franchise for which was recently granted by the Village Board of Trustees.

WAVERLY, N. Y.—The State Commission of Gas and Electricity has granted the Sayre Electric Company, of Sayre, Pa., permission to transact business in Waverly, N. Y., and also to lease the distributing system of the Waverly Light & Power Company for a term of 99 years.

TRYON, N. C.—G. Hamilton Holmes, chief engineer of the Tryon Electric Light, Water & Power Company, writes that the water works plant is nearing completion, and surveys have been completed and plans are now being prepared for power development. The cost of the proposed power plant is estimated at about $65,000.

FARGO, N. D.—The Northwestern Telephone Company is planning extensive improvements to the Fargo territory, which will involve an expenditure of about $25,000.

FARGO, N. D.—The North Dakota Independent Telephone Company is planning a number of improvements in North Dakota, which include the building of a new toll line to Carrington and the remodeling of the Jamestown and Bismarck exchanges, and additional circuits from Fargo to Hillsboro, Casselton and Valley City.

CINCINNATI, OHIO.—Gustav and Nicholas Wolf are contemplating the construction of a six-story power house to be erected at Pearl and Lawrence Streets.

COLUMBUS, OHIO.—The Columbus Citizens' Telephone Company has installed automatic telephones at Canal Winchester and Worthington and it is said that calls may be made from these points to the subscribers' telephones in this city, thus making a very convenient arrangement. If the plan proves a success the same thing will be adopted at a number of other points where the company has exchanges. So far, there seems to be general satisfaction with the automatic system in use here. As people become more accustomed to it, they like it better, although at first there was considerable complaint.

CRESTLINE, OHIO.—The Crestline Local Telephone Company has increased its capital stock from $50,000 to $75,000.

JOHNSTOWN, OHIO.—The capital stock of the Johnstown & Croton Telephone Company has increased its capital stock from $50,000 to $80,000.

LIMA, OHIO.—Plans have been drawn for an auxiliary light plant to be operated in connection with the water works system and to cost $30,000. The contract for lighting is now held by the local company, which is controlled by the Schoepf syndicate.

LORAIN, OHIO.—Plans are being prepared by Architects Ford and Rossman for the new power house of the American Shipbuilding Company.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company is contemplating installing a 120-kw. alternating-current generator this year. E. A. Beckstein is manager.

EL RENO, OKLA.—An ordinance has been passed by the City Council granting an electric light and power franchise to G. E. Bright for a term of 21 years.

LAWTON, OKLA.—Messrs. Larsh & Render, owners of the Norman Light plant, have purchased the Lawton electric light plant and will take charge July 1.

GRANITE. ORE.—It is stated that arrangements have been completed for the building of a transmission line from the Fremont power plant to the Greenhorn district. Work will be commenced this summer after the line is completed to Bourne.

PORTLAND, ORE.—The Oregon & Washington Lumber Manufacturers' Association will co-operate with the Cottage Grove Commercial Club in plans for the building of a railway from Portland to Cottage Grove via the Coast Fork of the Williamette River to connect with the road to be constructed from Roseburg to Marshfield. A. C. Dixon is chairman of the railroad committee of the Cottage Grove Commercial Club.

BRADFORD, PA.—W. R. Page, general manager of the Western New York & Pennsylvania Traction Company, states that the company proposes to rebuild the entire system in Bradford, and also to rebuild and extend the Lewis Run line. The company is also contemplating the construction of an electric railway from Eldred to State Line. Mr. Page also states that the company is to construct a line from Bradford to Carrollton.

BUTLER, PA.—The Butler, Saxonburg & Tarentum Street Railway has applied for a charter to build a road 26 miles long, which will open up a mineral spring territory.

CARMICHAELS, PA.—The Town Council has granted a franchise to the Masontown, Smithfield & Brownsville Street Railway Compnay. The company proposes to build a street railway from Masontown to Carmichaels; also from Carmichaels through Clarksville and Zollarsville.

CHAMBERSBURG, PA.—It is reported that a new electric light and power company will soon be formed by interests closely identified with the Blue Ridge Land & Hotel Company for the purpose of supplying electricity for both power and light in the vicinity of Monterey, Blue Ridge, Summit, Buena Vista, Highfield, Pen Mar and other resorts in the Blue Ridge section.

HAZLETON, PA.—The Consumers Electric Light & Power Company has decided to build a sub-station.

IRWIN, PA.—The Manor Valley Railway Company expects to place contracts during the next four weeks for the construction of an extension to the Pittsburg & Westmoreland Railway Company line, a distance of four miles.

KITTANNING, PA.—F. A. Moesta, general manager of the Kittanning & Leechburg Railways Company, writes that the company has recently purchased all the stock and franchises of the Kittanning Electric Light Company, and that the present plant will be dismantled as soon as the additional unit is installed at the Garretts Run power station.

LANSDOWNE, PA.—The Borough Council is considering a proposition from the Sharon Hill, Lansdowne & Upper Darby Railway Company for a franchise to operate a street railway on certain streets in the borough, in connection with a direct line from Philadelphia to Chester via the Market Street subway and the elevated line to the Union Station.

NORRISTOWN, PA.—The Schuylkill Valley Traction Company has filed a certificate with the State Department showing an actual increase of capital stock from $250,000 to $500,000 for the purpose of acquiring property. The company is authorized to increase its capital stock to $1,000,000.

READING, PA.—The United Traction Company is planning to build a new electric railway to Temple, to be operated in conjunction with the present line.

WEST CHESTER, PA.—It is reported that the officials of the Lancaster, Oxford & Southern Railroad are contemplating electrifying the line. It is said that power will be supplied from the McCall's Ferry plant when completed.

WILMERDING, PA.—Application will soon be made to the State Department at Harrisburg for charters for the North Braddock Electric Light Company, the Braddock Electric Light Company and the East Pittsburg Electric Light Company. Henry Harris, W. J. Hailey and Philip Geiss are the applicants. The three companies will complete their organization as soon as the charters are granted, and then will become affiliated with the United Electric Light Company, of Wilmerding, which

will supply the companies with electricity. The company has had considerable demand from East Pittsburg, North Braddock and Braddock for electricity for lighting purposes, and the charter under which it operates does not allow it to operate in these towns.

CHARLESTON, S. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 16, to furnish at the navy yard, Charleston, S. C., a quantity of motor driving outfits, conductors and conduit outfittings. Applications for proposals should refer to schedule 59. E. B. Rogers, paymaster general, U. S. N.

GREENVILLE, S. C.—The City Council has granted street railway franchises to the South Carolina Public Service Corporation, the Greenville-Anderson Interurban Line and a proposed line from Greenville to Williamstown.

ARMOUR, S. D.—Plans are being made by the Wagner, Lake Shore & Armour Traction Company to establish an electric lighting system in this place. Contracts for the machinery have been awarded to the Minneapolis Steel & Machinery Company.

BRISTOL, TENN.—The Bristol Belt Line Railway Company is planning to place contracts for the construction of about one and one-half miles extension to its line. The company is also on the market for a 250 to 300-hp engine and for two cars. S. M. Vance is superintendent.

CHATTANOOGA, TENN.—Official announcement has been made that the Chattanooga Railways Company will construct a surface line to the summit of Lookout Mountain. Other extensive improvements will be made by the company immediately. Surveys have also been made for a line to Lula Park and Minnehaha Falls.

LEBANON, TENN.—Work has commenced on the construction of the new power plant for the Cedar City mills, which will furnish the mills and the town with electricity for power purposes. The company is also contemplating extending its lines to Watertown.

AUSTIN, TEX.—The Home Telephone Company, of Los Angeles, Cal., which is controlled by Charles H. Huntington, has acquired a number of independent long-distance telephone lines in Texas, and local independent telephone exchanges at Fort Worth, Ennis, Waxahachie, Cleburne and a number of other towns. It is stated that the company will connect up several long-distance lines and invest not less than $5,000,000 in building extensions of the system in this state.

FT. SAM HOUSTON, TEX.—Bids will be received until July 24 by L. J. Fleming, constructing quartermaster, U. S. A., for the following work at this post: for furnishing and installing electric lighting fixtures in the following buildings: Post exchange and gymnasium, post hospital, officers' club, and two double stable guards and shop buildings; for electric wiring in two double stable guards and shop buildings; for furnishing pole lines and making service connections to all buildings before mentioned. Bidders are required to furnish names and places of business of manufacturer or manufacturers whose goods they propose to furnish.

PALESTINE, TEX.—The Palestine Electric Company has been reorganized as the Palestine Electric & Ice Company with a capital stock of $140,000. Improvements will be made to the system. B. F. Dubose is secretary.

MANCHESTER, VA.—The electric light committee of the Council on June 27 recommended the City Council to construct a municipal electric light plant, to cost about $40,000. E. W. Trafford, of Richmond, is engineer.

PETERSBURG, VA.—Announcement has been made that Judge Edmund Waddell has entered a decree in the United States District Court authorizing the Virginia Passenger & Power Company to expend about $50,000 for improvements to its Petersburg service. It is understood that in addition to installing new arc lamps for street lighting, the money will be used to increase the capacity of the water power plant at the locks from 1500 to 3000 horse-power by installing an additional generator and water wheel, and to install a new generator at the steam plant in this city to use in case of emergency, and also to improve the old head dam on the canal.

SEATTLE, WASH.—The Seattle Electric Company is planning to erect two sub-stations, to cost $20,000 each.

SEATTLE, WASH.—The extension of the municipal hydro-electric power plant on Cedar River is assured by the sale of the $2,250,000 issue of bonds to the Seattle banks. The bond issue will cover a water supply system from the Cedar River.

SPOKANE, WASH.—The Spokane Falls Placer Mining Company, which owns large placer grounds at the mouth of the Lardeau River in British Columbia, has filed a water right and is arranging to erect a tower and electric plant to supply the city of Trout Lake and nearby mines with electricity for light and power. The plant will cost about $10,000. J. B. Campbell, H. Moss, of this city, are interested in the property.

VANCOUVER, WASH.—Walter H. Moore has been granted a franchise to construct a street railway on certain streets in this city.

DE PERE, WIS.—The C. A. Lawton Company has made arrangements with the De Pere Electric Light & Power Company for electrical energy to operate its entire plant.

MAYVILLE, WIS.—The F. Paustian Milling Company has sold its electric plant in this city. The company has moved to Brillion where it has purchased another plant.

NEENAH, WIS.—The Wisconsin Telephone Company has recently purchased a site on which it will erect a new exchange building. The company is planning to extend its underground conduit system to Mill Street, Menasha. The improvements contemplated will involve an expenditure of more than $100,000.

WASHBURN, WIS.—The City Council has authorized the lighting committee to purchase the outside electrical equipment and business of the Washburn Electric Light & Power Company. The city is contemplating the erection of a dam on Sioux River, two miles east of Washburn, to furnish power to operate the electric plant.

STRATHCONA, ALB.—The Strathcona Radial Railway Company is applying for incorporation to build electric car lines in and around the city. Messrs, Jamieson & Rutherford are solicitors for the applicants.

CRANBROOK, B. C.—The Cranbrook Electric Light & Power Company will install a 700-kw, 6000-volt generator, with step-down transformers reducing the voltage to 2250 volts. A dam will be constructed at St. Mary's River.

VICTORIA, B. C.—The British Columbia Electric Street Railway Company has found it necessary to develop extra electrical power in the vicinity of this city. Address R. H. Sperling, superintendent.

SYDNEY, N. S.—The Cape Breton Electric Company expects soon to place contracts for the construction of a new sub-station in North Sydney. Contracts have recently been placed by the company with the Canadian General Electric Company for the following equipment: two 250-kw, two to three phase, high tension, oiled cooled transformers, from 2200 to 22,000 volts; two 250-kw oiled cooled transformers three to two phase 22,000 to 2200 volts; one 300-kw synchronous motor, coupled to a 300-kw, 500-volt railway generator, with necessary switching apparatus; Eugene F. Phillips Electrical Works, of Montreal, for 45 miles No. 4 semi-hard drawn copper wire; C. S. Knowles, Boston, Mass., for necessary insulators and hardware for a 14-mile transmission line between the main generating station in Sydney to the sub-station in North Sydney.

WINDSOR, ONT.—The Detroit United Railway Company, owner of the Sandwich, Windsor & Amherstburg Railway Company, has let the contract for the construction of a power house adjacent to the plant of the Canadian Salt Company. This building is to be a small one, as the company wishes to secure more power at once. In the fall a new building will be erected adjoining the new plant, and will be large enough to accommodate all of the machinery of the Windsor street railway system.

MEXICO CITY, MEX.—The Mexican Light & Power Company has sold the equipment of the plant San Lazaro of the old Mexican Gas & Electric Light Company to L. B. Speyer & Company, which will be installed in the plant of the Campeche Light & Power Company at Campeche. The price paid for the machinery was $150,000 and consists of a McIntosh & Seymour cross compound condensing engine of 600 hp, with condenser, steam pump, etc., a 400-kw, three-phase, 2300-volt, 60-cycle General Electric generator, a 75-kw marine type engine driven exciter, switchboard, feed panel and other accessories.

Company Elections.

AURORA, IND.—The directors of the People's Telephone Association have elected Col. Jacob M. Bauer as president to fill the vacancy caused by the death of the late George M. Roberts.

SVEA, MINN.—At the annual meeting of the Kandiyohi County Telephone Company held recently the following-named officers were chosen: J. O. Lundberg, president; F. C. Petersen, secretary and manager, and F. G. Handy, treasurer.

New Industrial Companies.

THE M. W. DUNTON COMPANY, of Providence, R. I., has been incorporated with a capital stock of $50,000 to take over the business of M. W. Dunton & Company. The new company will devote its attention exclusively to insulating material. The management remains the same.

THE TELEPHONE USERS GUIDE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000. The directors are: L. M. Ridgeway, T. L. Pryor, and C. W. Ridgeway, of New York, N. Y.

THE TIDEWATER CONSTRUCTION COMPANY, of Wilmington, N. C., has been incorporated with a capital stock of $100,000 by J. C. McEachin, Thomas W. Davis, J. W. Little, and J. A. McGeachy, all of Wilmington. The objects of the company are to build, equip and repair all kinds of railroads, electric power plants, telephone and telegraph lines, water power plants, and to buy and sell all kinds of materials needed for such work.

THE UNITED GAS ENGINE BUILDERS, of New York, N. Y., has been incorporated with a capital stock of $5,000 by F. P. Stillman, of New York; F. Conrad, of Newburg, and T. J. Barber, of Syracuse.

New Incorporations.

NEW DECATUR, ALA.—The Cumberland Telephone & Telegraph Company of Alabama has been incorporated with a capital stock of $5,000 by George R. Knox, Jr., Charles Carter and John C. Eyster.

CHEYENNE WELLS, COL.—The Cheyenne County Telephone Company has been incorporated with a capital stock of $3,000 by H. Y. Tarwater, W. P. Love and H. H. Lotz.

DENVER, COL.—Incorporation papers have been filed for a new electric line to connect Denver and Greeley, which will be known as the Den-

ver & Greeley Railroad. The officers of the company are: John C. Mosher, of Greeley, president; E. J. Decker, of Greeley, vice-president; J. D. Housman, of Denver, general manager. The capital stock of the company is $50,000.

ARTHUR, ILL.—The Arthur Mutual Telephone & Telegraph Company has been incorporated with a capital stock of $20,000 by Marion Watson and others.

LISBON, ME.—Articles of incorporation have been filed with the Secretary of State for the Lisbon Falls Gas & Electric Company with a capital stock of $50,000. The company proposes to manufacture and distribute gas and electrticity for lighting, heating, traction and power purposes in the towns of Lisbon and Durham. The officers are: William H. Plummer, president, and H. E. Plummer, treasurer.

PORTLAND, ME.—The Novo Power Company has been incorporated with a capital stock of $1,000,000 by James E. Manter, Clarence E. Eaton, Charles D. Fullerton, James H. McCann, C. W. Burnell and Millard W. Baldwin, of Portland.

RICHMOND, ME.—The Richmond Light Company has been incorporated with a capital stock of $10,000. The officers of the company are Benjamin F. Curtis, president, and A. E. Small, treasurer, both of Richmond.

KANSAS CITY, MO.—The Joplin & Pittsburg Railroad Company has been chartered with a capital stock of $5,000,000. J. J. Heill is president and A. J. Prescott is secretary, both of Kansas City.

SOUTH ORANGE, N. J.—The South Orange Illuminating Company has been incorporated by Ira A. Kipp, Jr., B. Leach and others. The company proposes to petition the Council for a franchise.

CORINTH, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Corinth Electric Light & Power Company, with a capital stock of $25,000. The incorporators are Warren Curtis, of New York City; Warren Curtis, Jr., of Corinth, and E. B. Coolidge, of Glens Falls.

LEWISTON, PA.—The Juniata Valley Electric Company has been incorporated with a capital stock of $5,000.

Legal.

SUIT IN SEATTLE.—Mr. Charles H. Baker, formerly at the head of the Louqualine Power Company, has asked in the Superior Court at Seattle, Wash., for an injunction to prevent the sale of the Seattle-Tacoma Power Company, in which he is interested, to the Seattle Electric Company, which action he declares is contemplated soon. He also demands an accounting from the officers and directors of the Seattle-Tacoma Power Company and a restitution of money expended by the company in acquiring the Diamond Ice & Fuel Company, and the Mutual Light & Heating Company, which deals, Mr. Baker claims, were made fraudulently.

RIGHT TO RESCIND CONTRACT FOR PURCHASE OF TELEPHONES.—Under a contract of sale the plaintiff shipped 104 telephones to the defendant. Half of the telephones were installed by the defendant and were found to be useless. The remainder of the shipment was not opened or tested in any way, and the defendant notified the plaintiff that it would not install any more phones until those already installed were remedied. It was held that the defendant was entitled to rescind the entire contract and was not liable for any part of the purchase price. Chicago Telephone Supply Company vs. Marne & Elkhorn Telephone Company, Supreme Court of Iowa, 111 N. W. Rep. 935.

LIABILITY FOR ACCIDENT RESULTING FROM UNGUARDED STREET EXCAVATION.—The defendant gas and electric company, while excavating for a trench in one of the streets of Council Bluffs, Iowa, left a pile of unprotected earth in the street. The plaintiff, chief of the city fire department, while being driven along the street in the night time in response to an alarm, was thrown out and injured by the vehicle in which he was riding coming in contact with the excavated earth. In reversing a judgment in favor of the plaintiff, the court said: "Cities and public service corporations having the right of entry, are privileged to tear up or obstruct a street, even to the full width thereof, if necessary, in the course of making public improvements or repairing the same; and it ought not to require discussion or argument to make it clear that the bare exercise of such a right may not be distorted into an act of negligence. Indeed, it is in the very nature of things, and hence fundamental, that negligence cannot begin until the limits of right have been overstepped. As there was no law, by statute or ordinance, governing the subject, we must assume that the defendant had the right to throw the dirt either way." Citizens' Gas & Electric Company, United States Circuit Court of Appeals, 152 Fed. Rep. 389.

ALLEGATIONS AND PROOF IN ACTION AGAINST ELECTRIC COMPANY FOR DAMAGES.—An action against a lighting and power company having resulted in a verdict in favor of the plaintiff for $1,000, the company appealed on the ground that there had been a variance between the allegations in the plaintiff's petition and the proof offered at the trial. The accident was a result of the negligence of the company in permitting one of its wires to fall and remain upon the plaintiff's yard gate, with which the plaintiff thereafter came in contact. The plaintiff alleged that the defendant negligently constructed and used "its said wire for the transmission of electricity over and upon the plaintiff's premises," and the evidence introduced indicated that the wires were suspended along the sidewalk from 8 to 10 feet from, and not across, the premises of the plaintiff. It was held that, if there was any variance, it was immaterial. The gist of the matter was whether the defendant was guilty of negligence in allowing a wire heavily charged with electricity to fall upon and remain in contact with the gate and the exact location of the wire was unimportant. The courts will disregard such petty, immaterial variances as can deceive no one.—Houston Lighting Power Co. vs. Hooper, Court of Civil Appeals of Texas, 102 S. W. Rep. 133.

RIGHTS OF ELECTRIC RAILWAY IN STREET.—An electric street railway company was authorized by legislative and municipal action to locate and operate its road on Eleventh Street, in the city of Philadelphia, and to place the poles along near the track in the center of the street; but the line was required to be constructed in compliance with a city ordinance which provided that "The laying, construction and maintenance of all wires, poles, or cables shall be under the supervision of the chief of the electrical bureau and subject to his approval." One of the poles, which the company erected pursuant to the authority obtained, stood upon a base about 2½ feet in diameter and 18 inches high. There was no light upon the pole, and a milk dealer, driving his wagon along Eleventh Street some time before daylight, ran into it and died as a result of the accident. It was held that, conceding the right of the railway company to place its poles in the center of the street, yet there was a duty imposed upon the company to exercise the power conferred by the municipality in such manner as not unnecessarily to obstruct the highway or to interfere with the purpose for which it was primarily constructed. The city of Philadelphia was held liable in damages for the death.—McKim vs. City of Philadelphia, Supreme Court of Pennsylvania, 66 Alt. 340.

TELEPHONE COMPANY LIABLE FOR INJURIES TO LINEMAN BECAUSE OF FAILURE OF FOREMAN TO WARN HIM OF DANGER.—The plaintiff was engaged at the time of the accident with other employees in erecting a large circle pole about sixty-five feet high and in transferring to it a messenger wire serving to support a cable. The general undertaking had been inaugurated before the plaintiff entered into the employ of the defendant company. At the direction of the foreman the plaintiff went up the pole to remove two of three cross arms which were rendered unnecessary by the installment of the cable, and in removing the second cross arm, which was just underneath the clamp to which the messenger wire had been attached, the pressure of the messenger wire which had rested on this cross-arm was relieved, so that the pole sprang back to normal position, from which it had been deflected by the messenger wire. This caused the safety strap which the plaintiff was using to snap and, as a result, the plaintiff fell backward to the ground. To recover damages for the injuries sustained the plaintiff brought action against the telephone company. It was held that the company was liable. If the plaintiff was in as good a position as the foreman to know what the consequences of removing the cross arm might be expected to be, then the plaintiff would have assumed the risk of the operation and would not have been entitled to recover. But it was shown that the foreman knew of the danger involved, which was not apparent to the plaintiff, and that he did not inform the plaintiff of this danger. And the failure of the foreman to give proper warning to the plaintiff before allowing him to ascend the pole and so place himself in a dangerous position constituted negligence for which the defendant telephone company was responsible in damages. Long vs. Johnson County Telephone Company, Supreme Court of Iowa, 111 N. W. Rep. 984.

RIGHT OF MUNICIPALITY TO EXCLUDE ELECTRIC COMPANY, ALREADY HOLDING FRANCHISE, FROM BIDDING ON NEW FRANCHISE, SOLD FOR PURPOSE OF PROMOTING COMPETITION.—The city of Louisville, Ky., advertised for sale a franchise or privilege to string wires along the streets of the city for the purpose of distributing and selling electricity. On the ground that the object of the sale was to secure competition, and that the Louisville Lighting Company already enjoyed a similar franchise, it was provided that no bid, received directly or indirectly from that company, would be considered. It was required of each bidder that he file a sworn statement to the effect that he was not acting in any way in the interest of the Louisville Lighting Company, or of any other person or company desiring to suppress or prevent competition in the sale of electricity. The franchise was sold to one Lawrence Jones for the sum of $100,150, and thereafter an action was brought for the purpose of having the sale declared invalid under section 164 of the constitution, which provides that no municipality should grant any franchise without publicly advertising for bids and awarding the franchise to the highest and best bidder, provided, however, that the municipality should have the right to reject any and all bids. It was held that the sale was not invalid under section 164. The evident purpose of this provision of the constitution was to prevent to councils of cities from giving away or selling at an inadequate price the rights and privileges belonging to the citizens. Thus construing the constitution, it is evident that it was the duty of the city council to take steps to relieve the people of the city from paying exorbitant prices for electricity for lighting purposes by establishing a competing plant and fixing a maximum price.—Stites vs. Norton, 101 S. W. Rep. 1189, Court of Appeals of Kentucky.

NEGLIGENCE OF TELEPHONE COMPANY IN LEAVING WIRES IN DANGEROUS CONDITION AND LIABILITY FOR ACCIDENT RESULTING THEREFROM.—In an action by an administratrix against a telephone company to recover damages for the death of the person whose estate she represented it was shown that the deceased, while walking beneath a tree in a suburb of Mobile, Ala., touched a wire fence that was nailed to the tree and was killed by an electric shock transmitted through the wire of the fence. The evidence showed that a

trolley pole of the Mobile Light & Railroad Company projected into the branches of this tree; that the span wire, attached to an eye bolt which ran through the pole, was heavily charged with electricity; that the defendant telephone company had formerly maintained a line along the trolley route and that, in removing its system, had left several wires dangling down through the branches of the tree under which the accident occurred; and that one of these wires became jammed between the washer and nut of the eye bolt and hung down almost to the ground, where it was "kind of hooked to the fence as though somebody had bent the end of it to keep it from swinging." It was shown that when a trolley wire is properly suspended the span wire is dead and that one should be insulated from the other by means of a bell, but that, in this instance, the trolley wire ran through the bell to the span wire and out to the eye bolt, where the telephone wire was jammed and the current was in this manner communicated to the wire fence. It was held that the act of the telephone company in permitting its wires to hang down constituted negligence and that the company was liable in damages. It was said: "It is the creation and maintenance of a dangerous situation without the warranting occasion for it which may exist when the lines are in use—without any occasion whatever, in fact; and the company is liable in damages for whatever injuries may result to persons and property rightfully on the premises."—Home Telephone Company vs. Fields, Supreme Court of Alabama.

STATE CONTROL OVER PATENTS.—In an opinion rendered by the Justices of the Supreme Judicial Court of Massachusetts, in answer to questions propounded by the Senate with a view to legislating upon a question involving the State control of patents, it was declared that the State has power to pass a general law, prohibiting licensees and owners of patents from leasing patented machines to others by a contract, prohibiting the lessees from obtaining from any other person similar machines to perform the same operation as that performed by the leased machine during the term of the lease. It was also the opinion of the Justices that the Legislature has authority to pass a general law providing that, where a patented machine is designed to perform two successive steps in the making of an article or product, the owner of the patent or license shall not lease or license the use of one of the machines designed to perform one of the steps on conditions in effect prohibiting the lessee or licensee from using in the manufacture of the article the leased machine, if a machine not obtained from the lessor is used to perform the other steps of the process during the term of the lease. It is well settled, as stated by Mr. Justice Harlan in Patterson vs. Kentucky, 97 U. S. 501, "that the right which the patentee or his assignee possesses in the property created by the application of a patented discovery must be enjoyed subject to the complete and salutary power with which the States have never parted, of so defining and regulating the use and sale of property within their respective limits as to afford protection to the many against the injurious conduct of the few. The right of property in the physical substance, which is the fruit of the discovery, is altogether distinct from the right in the discovery itself, just as the property in the instruments or plate by which copies of a map are multiplied is distinct from the copyright of the map itself." The patentee's right is a monopoly of the invention, but this does not protect from State legislation any monopoly in other commercial ventures which the patentee may attempt to establish.—In re Opinion of the Justices, 81 N. E. Rep. 142.

Personal.

MR. RALPH D. MERSHON, the consulting engineer, has gone to England again in connection with the Zambesi River power transmission project.

MR. JOHN A. HOLMBERG, of Denver, Col., is installing electrical machinery at the Bellevue-Hudson mine, Idaho Springs, Col., for the operation of compressors and hoists.

MR. H. W. WRIGHT, of Shreveport, La., is in charge of the construction of a generating plant at Stamford, Texas, embodying the latest ideas in power station design.

MR. J. P. MANYPENNY has been appointed the general representative of the Philadelphia Electric Construction Company, who have their headquarters at 914 Filbert Street.

MR. D. B. HERRING, manager of the Southwestern Telephone & Telegraph Company at Yoakum, Tex., has resigned to accept a position with the Missouri & Kansas Telephone Company at Kansas City.

MR. HENRY D. BRADLEE has been admitted as a member in the well known Boston financial and engineering firm of Stone & Webster, the other partners being Charles A. Stone, Edwin S. Webster and Russell Robb.

MR. HENRY L. DOHERTY has gone abroad for a rest and vacation, and sailed for Europe on July 2 on the Cunarder "Caronia." Mr. Doherty has been extremely busy of late with several lighting enterprises, which involved incessant travel, so he is to recuperate with a little more travel.

MR. WILLIAM L. DERR has been appointed general superintendent of the New York City Railway Company. He will have general charge of the street railway system of the city after July 1. Mr. Derr is a graduate of the Pennsylvania Polytechnic College at Philadelphia and has been in railroad work since 1876.

MR. H. M. BEUGLER, formerly superintendent of railways for Ford, Bacon & Davis, operating department, operating the Newman properties in Houston, Tex., Memphis, Little Rock, Birmingham, Nashville, and Knoxville, has taken a position with the firm of Dodge & Day, the well-known engineers and constructors of Philadelphia and New York.

MR. DUNCAN R. CUMMING, of Denver, Col., has been in and about Benson looking for tungsten ores. Tungsten has been discovered in the mountains surrounding Benson, and shipments were made by the Premis Chemical Company at Dragoon, from placer ground, but that company has opened up copper deposits and turned its attention from tungsten to mining the red metal.

MR. LEWIS B. STILLWELL was the recipient of two honorary degrees at commencement exercises this year—Master of Science from Lehigh University and Doctor of Science from Wesleyan University, at Middletown, where Mr. Stillwell pursued part of his undergraduate course. The degree from Lehigh was the third honorary distinction conferred by that university in its existence.

MR. C. H. HOLLINGSWORTH, superintendent for the Great Western Power Company, at Island Bar, Cal., has resigned his position and will return to his home in the East. His successor is Mr. B. S. Roberts, who has resigned from the Southern Pacific to take the place. Mr. W. H. Bissell, formerly purchasing agent for the Great Western Power Company, has been promoted to the position of assistant superintendent.

MR. W. H. COWELL.—Mr. A. D. Hatfield has resigned as secretary and treasurer of the Wellman-Seaver-Morgan Company, Cleveland, Ohio, and has been succeeded by W. H. Cowell, who was connected with the Algoma Steel Company, Sault Ste. Marie, Ont., of which Willard H. Sawyer was general manager before going to Cleveland to become president of the Wellman-Seaver-Morgan Company.

MR. GEO. F. ADAMS and Mr. Jas. R. Downs, who have been connected with the Westinghouse Electric & Manufacturing Company for the past ten years, have resigned from the Cleveland selling organization and have opened an office in the New England Building, Cleveland, under the style of Adams & Downs. They have an agreement with the Burke Electric Company, as selling representatives, to handle the complete line of alternating and direct current dynamos and motors manufactured by that company.

MORSE-THOMPSON.—The *New York Herald* has the following from Poughkeepsie, dated June 29: The Episcopal Church of St. Margaret in Staatsburg, Dutchess County, was the scene at noon to-day of the wedding of Miss Anna Thompson, cousin of Mr. Louis S. Thompson, of New York, whose summer home, Stonehurst, is in the town, to Mr. Samuel F. H. Morse, grandson of Professor Samuel F. B. Morse, who, when a resident of this country, invented the telegraph in 1841. The newly married couple will live in California.

MR. THOMAS TAIT, chairman of the Victorian Railway Commission, reached this country June 29 on his return to Melbourne. Mr. Tait has made an extensive tour in Europe, where he has visited the important railways which have been changed from steam to electric power and has been very much interested in this subject, as the electrification of the Victorian steam railways and the cable system in Melbourne is under consideration by the railway commission. The details of the system to be adopted have not yet been selected as this will be left to the expert of the system, Mr. Charles H. Merz, of London, who has been engaged to make an exhaustive report on the subject.

MR. FRANK KOESTER, a contributor to these columns, has a book now in the hands of D. Van Nostrand Company, to issue in the fall, devoted to the design of light and power central stations. Mr. Koester is an experienced power plant designer, having been in Europe connected with the design of plants for Europe, Asia, Central and South America, as well as the construction and operation of plants of from 1000 to 24,000-kw capacity. For the purpose of studying American power plants on a broader scale, their methods of design, construction and operation, he has been in this country for a number of years, identified with some of the largest plants, varying from 3000 to 60,000-kw capacity.

SIGNAL CORPS PERSONNEL.—The following orders have just been issued affecting the U. S. Signal Corps: Captain George S. Gibbs, to army of Cuban pacification as chief signal officer, relieving Captain William Mitchell. First Lieutenant Walter H. Smith, from Army Staff College, to command Company A, signal corps, Fort Leavenworth, relieving First Lieutenant George E. Kumpe, who will proceed to Havana for duty under chief signal officer, army of Cuban pacification. First Lieutenant E. Alexis Jeunet, from Signal School to Havana, for duty under chief signal officer, army of Cuban pacification. Major George O. Squier, Signal Corps, from Fort Leavenworth, to office chief signal officer at Washington.

MR. JOHN H. SMART, who has just retired from the position of superintendent of the Commercial Cable Company at New York, was given a farewell banquet recently in Brooklyn, when he was presented by his many friends with a solid silver service and tray, accompanied by an illuminated address. The presentation was made by Mr. Frank Mason, who made a highly appropriate speech. Mr. Smart was born at Bristol, England, in 1859. In 1880 he came to the United States and for three years was in the employ of the French Cable Company at Cape Cod. Subsequently he filled a position with the Western Union Cable at Canso, N. S. His service with the Commercial company began as an operator. In 1886 he was appointed assistant superintendent, succeeding to the superintendency on January 1, 1896.

MR. B. S. JOSSELYN.—At a meeting of the directors of the Baltimore Electric Company last week, Mr. Benage S. Josselyn resigned from

the office of vice-president and general manager to become at once president of the Portland Railway, Light & Power Company, of Portland, Ore. Mr. Josselyn was also vice-president of the Maryland Telephone Company, which position he has also resigned. Mr. Josselyn's resignation came as a surprise to the directors, but the position tendered him in Portland is one which offers many opportunities, and he felt that he should accept it. The Portland Company is controlled principally by E. W. Clark & Company, of Philadelphia; J. W. Seligman and Pratt & Company, of New York, and the properties it owns represent an investment of about $40,000,000. The gross earnings of the properties are in excess of $5,000,000 a year. The company owns all the street railway lines in Portland, controls the light, power and steam-heating field, furnishes hydraulic water power in Portland and nearby towns, including Salem, the capital of the state, where it also owns the gas plant, and owns the ferry lines on the Williamette and Columbia Rivers. The various enterprises of the company represent over 100,000 horse-power. Mr. Josselyn will succeed Mr. H. W. Good, who died last April. Mr. Josselyn went to Baltimore about two years ago from the West to become assistant to the president of the Maryland Telephone Company, and two months later was elected vice-president. Mr. Josselyn is a native of Illinois and has had an extensive experience in the management of steam and electric railways, electric light and telephone enterprises.

Trade Publications.

PUMPS.—The D'Olier Engineering Company, 119 South Eleventh Street, Philadelphia, Pa., has recently issued a bulletin on centrifugal pumps. Pumps of various sizes, designed for direct connection to electric motors are illustrated. These pumps are made in two types—volute and turbine.

TRUMBULL EXPANSION.—The Trumbull Electric Manufacturing Company, Plainville, Conn., has just issued a unique folder, circular in shape, representing its trademark. Inside are shown illustrations of the company's factory of 1901 and that of to-day. The comparison tells a story of large and rapid expansion.

Business Notes.

A. L. IDE & SONS.—The New York office of A. L. Ide & Sons, the "Ideal" engine, formerly at 11 Broadway, is now located at 90 West Street.

CHANGE OF ADDRESS.—The San Francisco office of the Electrical World has moved from 701 to 601 Atlas Building.

THE E. H. FREEMAN ELECTRIC COMPANY, of Trenton, N. J., is making arrangements to add a third plant to the two already operated by the company. The concern manufactures all kinds of fittings for electric wiring and lighting. The company has just commenced the manufacture of a new socket for electric lamps on electric signs. This socket has just been put on the market.

THE WESTERN WIRE SALES COMPANY, of Chicago, Ill., announces that it has been made general Western agent of the Bay State Insulated Wire & Cable Company, Hyde Park, Mass. This company has recently been organized with Andrew J. Conlin as general superintendent, and J. H. H. McNamee is treasurer and general manager. Outside of the regular lines of the rubber and lead covered insulated wires and cables, this company is making a specialty of railroad signal wire to meet any specifications 30 per cent pure Para rubber insulated wires and cables, mining cables, flame-proof wires, telephone wires, etc.

BILLET CONVEYING.—One of the oldest and most prominent firms identified with the steel industry in America, is the Alan Wood Iron & Steel Company, whose establishment at Conshohocken, Pa., about a dozen miles from Philadelphia, dates back eighty-odd years. During all these years this firm has witnessed the introduction of many improvements in manufacturing and seen many mechanical devices for the facilitating of production and handling put into operation. The electrically-operated conveying equipment for expediting the movement of hot and cold billets at its Ivy Rock Mill, indicates that even if the firm is old as years are counted, it is not lacking in up-to-date equipment for increasing facilities. When the ingot is of equal heat from centre to corners, it is brought to a transfer table by crane. The movement of the table is controlled by an operator shielded from, but in plain view of, a tri-section roughing roll. The table takes the ingot to the roll, through which it passes forward and backward several times. The lengthened ingot is then passed to the second section and again rolled; the proper length and thickness being finally obtained by a few passes through the third section of the roll. The cutting of the cold steel bars is done on the opposite side of the mill; the long bars being brought to the cutter by transfer table controlled, as in the rolling, by a man in plain view of the cutter. When the current is turned on, a certain length of the bar passes under the cutter, the part remaining on the table being automatically clamped to hold the bar securely while being cut. The cutter comes down with a pressure of 500 lbs. in the cylinder and the severed portion of steel drops onto a Link-Belt inclined apron-conveyor which delivers the billets to cars running on a narrow gauge track.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

(Published first issue of each month.)

American Electro-Therapeutical Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, New York City.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, United Engineering Societies Building, 29 West 39th St., New York. Meetings, fourth Friday of each month.

American Street and Interurban Railway Engineering Association. Secretary, Walter S. Mower, London, Ont.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, United Engineering Societies Building, 29 West 39th St., New York.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Detroit, Mich., third Wednesday, September, 1907.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York. Next meeting, Atlantic City, N. J., October 14-18, 1907.

Association of Edison Illuminating Companies. Secretary, H. C. Lucas, 10th and Sansom Sts., Philadelphia, Pa.

Association of Electric Lighting Engineers of New England. Secretary, Wells E. Holmes, 308 Washington St., Newton, Mass. Annual meetings held in Boston, third Wednesday in March.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Montreal, Que., June 26, 27 and 28, 1908.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont. Next meeting, Montreal, September, 1907.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St. W., Toronto, Ont.

Central Electric Railway Association. Secretary, W. F. Mulholland, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Secretary, John F. Dostal, 405 17th St., Denver, Col. Next meeting, September, 1907.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, John P. Faure, 77 Water St., Ossining, N. Y.

Electrical Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 1537 Old Colony Building, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, Wm. R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, November 7, 1907.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electrical Association. Secretary, Charles H. B. Chapin, 154 Nassau St., New York. Next meeting, October, 1907.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, La Salle, Ill.

Illuminating Engineering Society. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York, second Friday of each month.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Norfolk, Va.

International Independent Telephone Association. Secretary, Charles West.

Iowa Electrical Association. Secretary, L. B. Spinney, Iowa State College, Ames, Ia.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia. Next meeting, Cedar Rapids, Ia., second Tuesday, March, 1908.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., Oct. 16, 1907.

KENTUCKY INDEPENDENT ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting second Tuesday in October each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Battle Creek, Mich., August 21-23, 1907.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Houck McHenry, Jefferson City, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Philadelphia, Pa.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee St., Utica, N. Y. Next meeting, New York City, July 17, 18 and 19, 1907.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

NATIONAL INTERSTATE TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, Roger N. Kimball, Kenosha, Wis. Next meeting, Milwaukee, January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next meeting, Toledo, August 20 and 22, 1907.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Ballard, 104 Canal St., Cleveland, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Charles W. Ford, Oklahoma City, Okla.

OLD TIME TELEGRAPHERS AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York. Next meeting, Niagara Falls, N. Y., 1907.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 136 South Second St., Philadelphia, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting second Saturday of each month.

PUBLIC UTILITIES ASSOCIATION OF INDIANA. Secretary J. A. Shunk, Peru, Ind. Regular meetings second Thursday in May and December.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, R. B. Stichter, Dallas, Tex. Next meeting, El Paso, Tex.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury, Vt.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 55 Kilby St., Boston, Mass. Next meeting, March, 1908.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 25, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

857,569. ELECTRIC CURLING IRON; Isabel Allen, Kansas City, Mo., and George Hanlon, Shawneetown, Ill. App. filed Oct. 16, 1906. Construction of curling iron having a tubular member with a resistance element spirally contained therein, and a slideable switch or controller in the handle by which a greater or less resistance may be included in the circuit.

857,591. TROLLEY HARP; Arlington D. Brittain, Youngstown, Ohio. App. filed April 18, 1906. The trolley harp has a pair of arms bolted thereto and projecting rigidly upwardly therefrom and adapted to guide the wheel on the wire. A specially constructed wheel having removable flanges is employed.

857,606. BATTERY; Frank A. Decker, Philadelphia, Pa. App. filed March 30, 1904. In a battery, a compartment having imperforate walls of porous material, a fragmental electrode in said compartment, and means in said compartment for permitting the free circulation of fluid and contact thereof with said electrode, substantially as specified.

857,607. ELECTROCHEMICAL APPARATUS; Frank A. Decker, Philadelphia, Pa. App. filed Jan. 16, 1906. In an apparatus of the class described, a plurality of envelopes, and a rubber conduit conforming and vulcanized to the bottoms and communicating with the interiors thereof.

857,612. TROLLEY STAND; Edgar L. Fixler, Delta, Ohio. App. filed July 12, 1906. Mechanical features of a trolley stand from which the pole is quickly detachable. The object is to provide for the change in the quickest possible time, and with the least danger to the operator.

857,621. SWITCHING DEVICE; Alexander M. Haubrich, Chicago, Ill. App. filed Sept. 28, 1904. Construction of switch for telephone systems where separate lines are operated in conjunction with single subscriber lines. Has a two-way key and a plurality of depressible buttons.

857,643. TROLLEY GUARD; George L. Matheney, Bridgeport, Ohio. App. filed July 12, 1906. A pair of vertically depressible cheeks are slidable in spring impelled relation at each side of the trolley wheel so as to yield downwardly in passing guy wires, etc.

857,664. ELECTROMEDICAL APPLIANCE; David R. Overman, St. Louis, Mo. App. filed Jan. 10, 1907. A pad or bandage comprising a cushion of soft leather prepared with wool thereon and having a pocket with a battery therein, the terminals of which extend into the wool of said cushion.

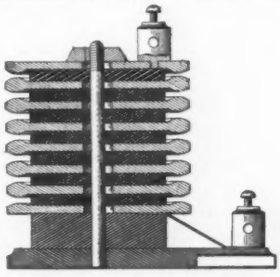
857,686. ELECTRICALLY PROPELLED VEHICLE. Russell Thayer, Philadelphia, Pa. App. filed April 4, 1907. An electric truck of the type adapted to run on a car track and receive current through a trolley pole when this is possible, but having storage batteries by which it may proceed independently of the trolley when desired.

857,707. DEVICE FOR PERMITTING THE AUTOMATIC OPERATION OF FIRE ALARM BOXES; Leonidas G. Woolley, Lima, Ohio. App. filed Aug. 31, 1906. Has a revoluble arm rotarily impelled by a spiral spring and resisted in its movements by a fusible element.

857,708. CIRCUIT OPERATING DEVICE; Leonidas G. Woolley, Lima, Ohio. App. filed Aug. 31, 1906. Relates to modifications of the above.

857,735. FUSED PLUG AND RECEPTACLE; John C. Hatzel and Edgar L. Morley, New York, N. Y. App. filed Jan. 5, 1906. Features of construction of a plug adapted to receive a standard fuse and having all the metallic parts covered so as to avoid all possibility of accident by short circuit.

857,752. MECHANICAL POWER BRAKE; Louis Pfingst, Boston, Mass. App. filed March 6, 1903. The usual hand brake has a motor armature thereon which acts to assist the application of the brake whenever the circuit thereof is closed.



857,849.—Lightning Arrester.

857,792. RAILROAD BRAKE; Howard A. Coleman, Sanborn, Ia. App. filed March 4, 1907. A special construction of motor for the application of a brake, both the armature and the fields having spaced polar projections.

857,797. MOTOR CONTROL APPARATUS; George W. Euker, Pittsfield, Mass. App. filed Aug. 31, 1905. A flexible cord is connected to the usual arm of the starting rheostat and this flexible cord terminates in a push button switch. By pulling the cord and operating the switch, an operator of a printing press may control the entire action from any desired location.

857,849. LIGHTNING-ARRESTER; Joseph V. E. Titus, Keokuk, Ia. App. filed Oct. 20, 1904. Construction of lightning-arrester having a plurality of plates arranged with spark gaps formed between the same, and having a layer of resistance material arranged between each of said plates and out of the path formed by said gaps.

857,866. INDUCTION COIL; Morris W. Brinkmann, New York, N. Y. App. filed March 14, 1905. Construction of induction coil provided

with two or more interrupters operating simultaneously to break the primary circuit.

857,880. PRIMARY BATTERY; Charles E. Hite, Philadelphia, Pa. App. filed Nov. 15, 1904. In a primary battery the combination of a plurality of cells, a body of electrolyte, the cells opening at their bottom into said body of electrolyte and means of causing a flow of electrolyte from said body upwardly through the cells and then downwardly upon the outside walls thereof.

857,890. AUTOMATIC SAFETY STOP DEVICE FOR ELECTRIC VEHICLES; John T. McIntosh, Chicago, Ill. App. filed June 14, 1902. An automatic safety stop device for brake mechanism comprising a device in the controller arm, and means automatically operated by said device for opening the air brake valve in case the motorman is incapacitated.

857,909. ELECTROLYTIC CELL; Alfred O. Tate, New York, N. Y. App. filed Sept. 28, 1904. An electrode for an electrolytic cell having positive and negative conductors of relatively good conductivity located adjacent to each other and separated by an insulating medium, the lateral edges only being exposed to the electrolyte.

857,910. APPARATUS FOR TREATING LIQUIDS ELECTROLYTICALLY; Alfred O. Tate, New York, N. Y. App. filed Sept. 28, 1904. Relates to modifications of the above.

857,926. PROCESS OF PRODUCING STEEL DIES; George F. Diez, New York, N. Y. App. filed Feb. 5, 1907. The method of depositing iron upon a conducting surface which consists in subjecting the surface to be coated to the action of an electric current in an electrolyte containing iron sulphate and sodium bicarbonate.

857,927. PROCESS OF RECOVERING THE NICKEL CONTAINED IN BASIC NICKEL PRECIPITATES; Herbert H. Dow and Walter S. Gates, Midland, Mich., and Arthur E. Schaefer, Cleveland, Ohio. App. filed April 18, 1906. In the process of rendering soluble the nickel contained in basic nickel precipitates, the step which consists in treating such a precipitate with free halogen.

857,929. STORAGE BATTERY ELECTRODE; Thomas A. Edison, Orange, N. J. App. filed March 30, 1905. An electrode mass for storage batteries employing alkaline electrolytes, comprising an intimate mixture of a suitable active material and metallic flakes, scales or films formed wholly or in part of metallic cobalt, substantially as set forth.

857,953. ALTERNATING CURRENT MACHINE; Ralph D. Mershon, New York, N. Y. App. filed July 5, 1904. In an alternating current machine, adapted for variation in the number of its poles, the combination with the primary element, of a secondary element, resistances in the secondary element, and permanent connections for said resistances with the secondary winding or windings at such points that said resistances become successively more effective in their action as the number of poles is increased, as set forth.

857,950. AUTOMATIC TELEPHONE EXCHANGE; N. E. Norstrom, Junction City, Kan. App. filed May 31, 1900. The combination with a switching mechanism and magnets for operating it, of a generator and connections for sending electrical impulses for controlling said magnets, a crank for operating said generator, an adjustable indicator for controlling the impulses sent by said generator, and means for operating said indicator by the movement of said generator.

857,966. AUTOMATIC TELEPHONE SWITCH; C. M. Thompson, Chicago, Ill. App. filed Jan. 25, 1907. In an automatic telephone switch, the combination of a motor magnet having two windings and an electromagnetic device combined with means for closing the circuit through both of said windings one after the other by a single operation of said device.

858,002. SPEED GOVERNOR FOR DYNAMOS; Edward B. Jacobson, Pittsfield, Mass. App. filed Jan. 18, 1004. A fly wheel driven dynamo having an electromagnet varying the contact of the pulley with the fly wheel in accordance with the intensity of the current.

858,011. METER; William J. Mowbray, New York, N. Y. App. filed April 30, 1906. Electric meters of the type adapted for use in testing service meters installed on the premises of consumers of electric energy.

858,016. ARMATURE TESTING APPARATUS; Victor Patton, Hastings, Col. App. filed May 24, 1906. An apparatus for testing armature windings by which "shorts," grounds, "cross" and similar defects may be located.

858,059. ELECTROPLATING APPARATUS; David F. Broderick, New Britain, Conn. App. filed Aug. 10, 1906. Provides means whereby work to be plated can be started from a given point or station and made to return thereto, the work being deposited successively into various baths during its travel.

858,064. SIGNAL; Harold W. Eden, Detroit, Mich. App. filed Feb. 5, 1906. Construction of housing for ordinary magneto having a cover with a grooved edge to permit the insertion of a dust excluding sustance.

858,117. MEDICAL BATTERY; Charles W. Taylor, New York, N. Y. App. filed Dec. 22, 1905. Construction of medical battery having an induction coil and a movable sleeve therefor, and means connected with the movable sleeve and adapted to engage switch contacts to turn the electric current on and off.

858,120. SIGNALING SYSTEM FOR ALTERNATING CURRENTS; Louis H. Thullen, Edgewood Park, Pa. App. filed March 2, 1906. Relates to block signaling on railroads where alternating currents are employed to actuate the signals. Provides an inductive bond between the track sections which will be opaque to alternating currents, but give a free path for the passage of the propulsion current from block to block.

858,135. ELECTRIC TANK SWITCH; Jacob T. Anderson, New York, N. Y. App. filed May 17, 1906. The switch blade is carried by a revoluble drum which a flexible cord passes, one end of which carries a float extending into the water in the tank.

858,160. ANODE; Alexander J. Deloye, Torrington, Conn. App. filed Jan. 31, 1907. An anode for electroplating, of downwardly tapering form and having a series of integral outwardly projecting spurs or projections thereon.

858,196. APPARATUS FOR PRODUCING ELECTRIC SPARKS; William Marshall, New York, N. Y. App. filed Oct. 29, 1906. Relates to apparatus for producing oscillating electric discharges for the ignition of an explosive mixture in internal combustion engines or other purposes. Has a single battery and a three-wire connection with the primaries of two coils, the secondaries also being in a three-wire circuit with a triple pointed spark plug.

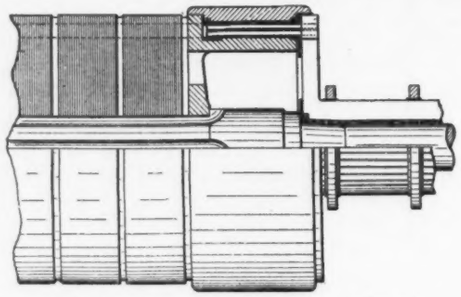
858,211. ELECTROMAGNETIC LOCOMOTIVE; Joseph L. Potter, Indianapolis, Ind. App. filed Dec. 11, 1905. A toy electric carriage having a walking beam oscillated by two electromagnets and a crank connection therefrom for driving the wheels of the vehicle.

858,216. TELEGRAPH REPEATER; Worth Rogers, St. Louis, Mo. App. filed Dec. 13, 1904. Details of circuit by which certain faults in the present apparatus with respect to false signals are corrected.

858,222. ELECTRIC CIRCUIT CONTROLLER; Max Schuppe, New York, N. Y. App. filed Jan. 7, 1905. Provides means for automatically breaking the circuit through mechanism operated by a motor, and for breaking said circuit gradually so as to prevent all danger from sparking, and from too abrupt changes of current strength.

858,238. TROLLEY FINDER; Frederick G. Weber, Ashland, Ky. App. filed Feb. 19, 1907. A V-shaped frame is pivoted in advance of the usual wheel and is impelled upward by the trolley cord when the wheel is being positioned on the wire.

858,246. DIRECT-CURRENT DYNAMO-ELECTRIC MACHINE; Edwin C. Wright, Newport, Ky. App. filed Nov. 30, 1906. Provides means for supporting, centering and retaining in position a ring for



858,246.—Direct-Current Dynamo Electric Machine.

the projecting portions of the coils at the commutator end of the machine.

858,255. TROLLEY FOR ELECTRIC RAILWAYS; Harry Bennett, Newark, N. J. App. filed April 17, 1906. The upper end of the trolley pole is formed in a separate section which telescopes into the main portion and is spring impelled outward therefrom.

858,288. BRANCH BOX; Albert F. Hills, Syracuse, N. Y. App. filed Oct. 10, 1905. A branch box for electric wires which is particularly applicable for exposed conduit circuit. Relates to features of construction by which the connections are made water-tight.

858,317. CORN POPPER; George B. and Joseph H. Young, El Paso, Tex. App. filed Nov. 30, 1906. A cylindrical drum or hopper is rotated on a vertical axis and has a resistance element sinuously embedded in its lower face.

858,325. PROCESS OF PRODUCING VANADIUM AND ITS ALLOYS; Frederick M. Becket, Niagara Falls, N. Y. App. filed June 19, 1906. The process of producing vanadium which consists in reacting on a vanadium compound reducible with silicon and carbon.

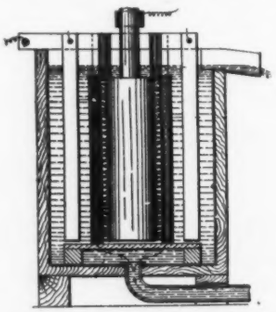
858,327. ALLOY AND METHOD OF PRODUCING IT; Frederick M. Becket, Niagara Falls, N. Y. App. filed March 20, 1907. Method of making an alloy containing titanium and calcium.

858,328. PROCESS OF REDUCING VANADIUM SULFID; Frederick M. Becket, Niagara Falls, N. Y. App. filed March 5, 1907. The process of reducing vanadium sulfid which consists in reacting thereon with silicon.

858,329. PROCESS OF EFFECTING CHEMICAL REDUCTIONS AND PRODUCING METALS AND ALLOYS; Frederick M. Becket, Niagara Falls, N. Y. App. filed April 12, 1907. The process of reducing oxides which consists in effecting a partial reduction by carbon and a further reduction by silicon carbide.

858,335. APPARATUS FOR MEASURING ELECTRICAL RESISTANCES; Sydney Evershed, Chiswick, England. App. filed Feb. 28, 1906. Has a hand dynamo and a Wheatstone bridge and a coil control galvanometer in which the control coil is connected between the two poles of said dynamo and the working coil is connected to either end of said Wheatstone bridge.

858,341. APPARATUS FOR ELECTROLYTIC DEPOSITION OF METALS; Herbert C. Harrison, London, and Joseph Day, Weston-



858,341.—Apparatus for Electrolytic Deposition of Metals.

Super-Mare, England. App. filed Aug. 7, 1902. Relates to the electrolytic deposition of metals whereby a tough and homogeneous deposit with a smooth surface is obtained with high current density.

858,351. INSTANTANEOUS ELECTRIC WATER HEATER; Herbert N. Roche and Fred F. Breese, San Francisco, Cal. App. filed Oct. 20, 1904. Construction of water heater having a tank through which a spirally wound resistance element extends, and a switch connected to the cock or faucet by which the current is turned on only while the fluid is being drawn through the tank.

858,355. TROLLEY CATCHER; Robert Shields, South Boston, Mass. App. filed March 14, 1906. A trolley retriever having a spring drum connected to the cord and having a detent by which it is locked in case the trolley leaves the wire. Relates to mechanical features of construction.

12,664. DUPLEXING TELEGRAPH LINES; Isidor Kitsee, Philadelphia, Pa. App. filed May 25, 1907. Duplex system for submarine telegraphy or lines having very high capacity.